PLASTICS

AUGUST 1959

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

Extrusion Flow . . . . . Precision Molding
Polyurethane Foam . . . . Laminate Stresses

University Microfilms, Inc.,
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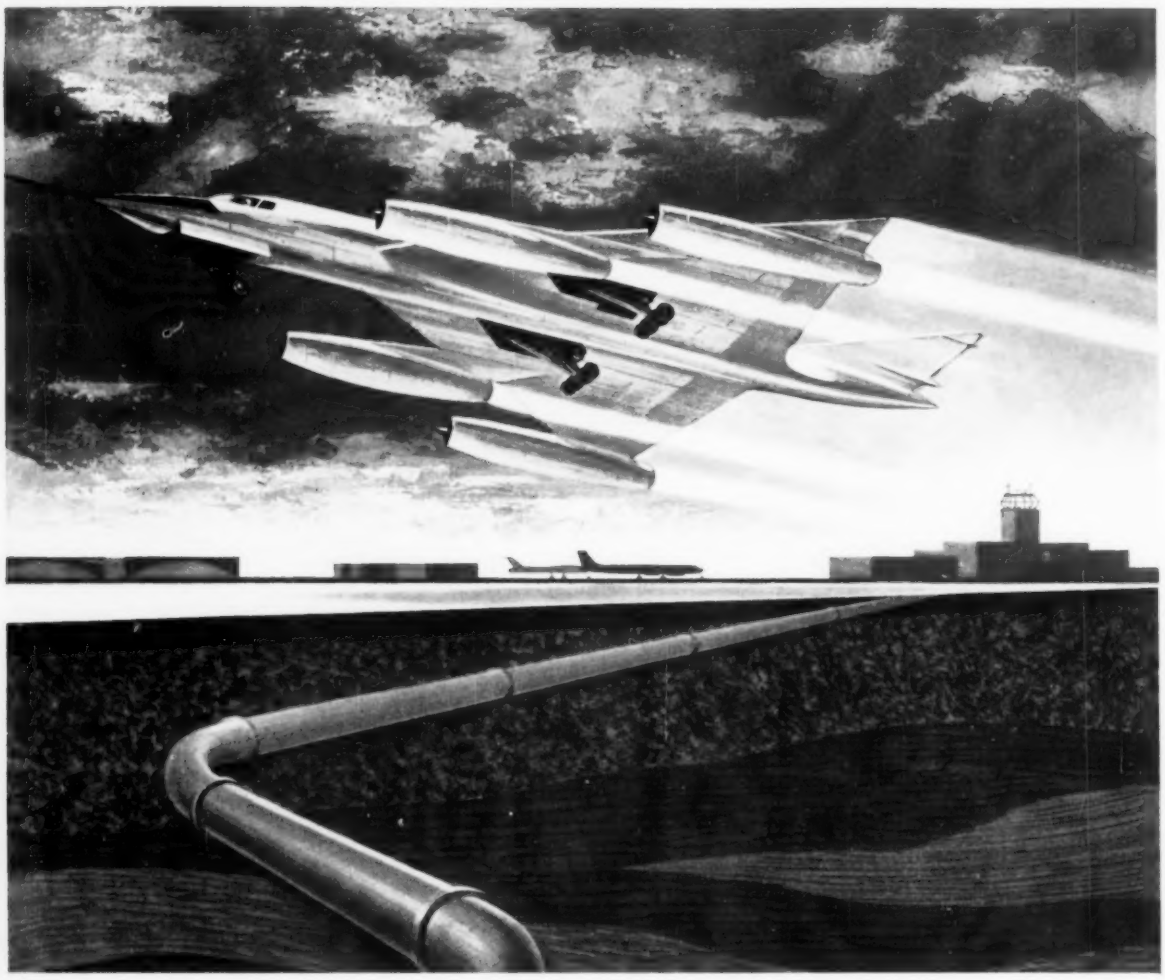
P&E



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add the comfort and quality touch to high style in casual furniture!

To protect bare-armed sun seekers from rude surprises and blistered forearms . . . Compacto,* outstanding producer of aluminum casual furniture, has styled its modern new line of chairs and chaises with three different sizes of arm rests molded of colorful CATALIN High Impact STYRENE.

Because of its insulating properties, CATALIN STYRENE remains comfortable to the touch, regardless of how much heat the sun radiates . . . and in the High Impact grade it easily stands the jostling, bumping and exposure to which outdoor furniture is subjected.

Whether you have a thermal, electrical, chemical or mechanical problem, Catalin's wide range of plastics—Polystyrene and Styrene Copolymers, Polyethylenes, Nylons and the new Polypropylenes—for molding, blow molding and extrusion applications, offer unlimited opportunities for product improvement. Inquiries invited.

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Catalin Corporation of America **One Park Avenue, New York 16, N. Y.**

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

Aug. 1959, V., 8

feature articles:

studying extrusion flow lines p. 27

by L. F. STREET

Tests are described for determining flow paths followed by molten plastic materials during extrusion. These tests were made by using a multi-colored feed of cold granules in a plasticizing extrusion operation. After a stable extrusion operation was obtained, the machine was stopped under full load, the screw removed, and the material in the screw channel observed. The need and direction for future test programs is stressed.

production problems with polyurethane foam p. 33

by J. P. McMAHON

Production molding of polyurethane foam can be hampered by many problems. These involve the starting materials, polymer reactions, the emulsifier used, and variations in mold temperatures that can affect foam fill-in, cell structure, and viscosity or density.

effects of stress concentrations on laminate strength p. 35

by E. L. STRAUSS

A comprehensive test program was undertaken on glass-polyester laminates containing various stress concentrations. Specific attention was paid to the effects of holes, cut-outs, notches, and fillets on specimens loaded statically in tension, compression, and flexure. The test program is described, and the results obtained are presented and discussed.

precision molding p. 40

by DAVID BINCH

In setting up its precision molding area for production runs of molded parts due attention was paid by this company to materials used; dimensional tolerances required of the resultant moldings; proper design of presses, hydraulic systems, and molds; and the use of continuous and rigid quality-control methods to ensure proper production results.

guest editorial:

decorative plastics laminates in the home p. 32

by A. J. MALASHEVITZ

engineering forum:

machinery maintenance p. 43

by GEORGE E. VENTZ

Corrosion and Prevention

exploring fabrication techniques:

aerosol containers · blow molding · potting compounds p. 44

by L. J. ZUKOR

feature story:

pre-met meets mold problem p. 39

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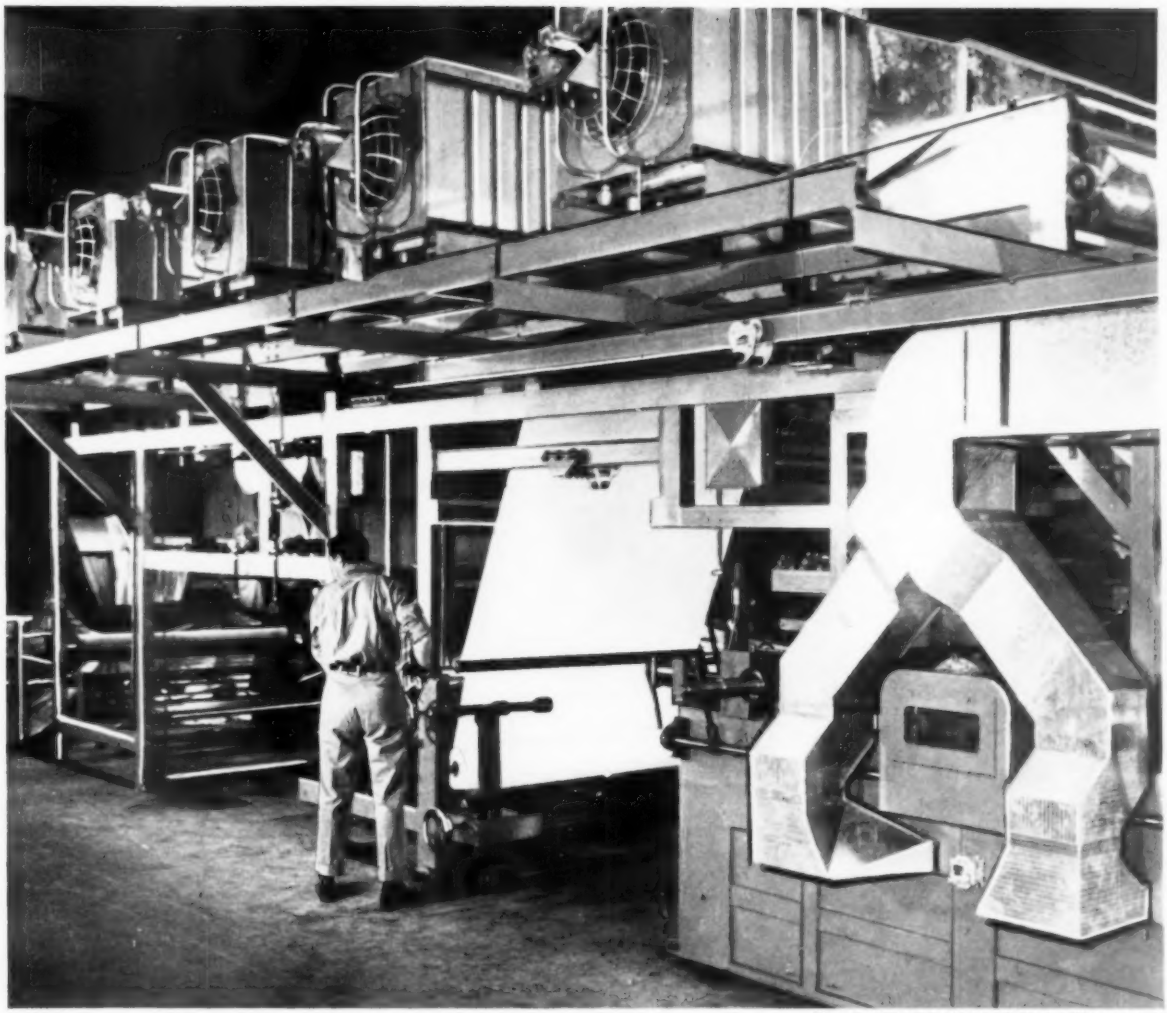

Photo courtesy Lembo Machine Works, Inc., Paterson, N. J.

PLASTISOLS . . . for finer fusion of film to fabric

Film-to-fabric lamination, with its more durable, lower-cost end product, is fast growing in popularity. The reasons: efficient equipment, such as that pictured above, plus the use of laminating adhesives based on PLIOVIC AO.

The advantages of PLIOVIC AO as the resin in a laminating plastisol are: 1. Its low fusion temperature protects against the loss of a film's embossing, the distortion of a printed pattern or damage to a synthetic fabric. 2. Its copolymer composition and low soap content provide excellent adhesion. 3. Its gelation and flow characteristics permit close control of strike-through and make for easy processing.

All this adds up to a higher quality laminate at lower cost. It also adds up to an excellent reason why you should learn more about PLIOVIC AO in laminating plastisols. Full details, including the latest *Tech Book Bulletins*, are yours simply by writing Goodyear, Chemical Division, Dept. H-9141, Akron 16, Ohio.

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Letters to the Editors

Film Extrusion vs. Film Calendering

Dear Sir:

We have been asked to evaluate various aspects of film extrusion versus film calendering. To limit the scope of such a broad subject, we are primarily interested in the production of polyethylene flat film and rigid PVC sheet.

We would appreciate any comments from you on the relative merits of calendering and extrusion of the above two types of products. In addition, can you refer us to any publications or articles that might contribute information or data that would prove helpful?

The basic factors we would like to consider are the relative costs of setting up a compounding and/or an extruding, calendering setup plus size and gauge limitations, rates of production, and other pertinent points of comparison.

J. F. Magee,
Inductomatic Extruder Sales,
Farrel-Birmingham Co., Inc.
Ansonia, Conn.

(In reply to this letter, Lee Zukor, our Engineering Editor, said in part "my personal views on when to use an extruder and when to use calenders are based on sheet thickness. A thickness under 10 mils should be extruded, while a thickness over 10-15 mils should be calendered. I base this on the fact that draw-down rates on an extruded film have been tried at 1,000 feet per minute. To my knowledge, no calender could supply acceptable film at anything approaching that rate. While a sheet 0.125-inch thick is extremely difficult to extrude, it can be calendered with ease." Zukor also gave a list of applicable publications that could be used to compare and evaluate the two processing methods.—Editor)

• • •

Books on Polyesters and Epoxies

Dear Sir:

We would like to obtain a listing of the major works on polyester resins and epoxy resins, their technology and their applications, especially in conjunction with fiberglass. The applications of these materials in the boat building field are our main interest, but we wish to become better acquainted with other applications, too.

Can you help us in this matter? We would appreciate any assistance you can give.

R. A. Cesak
Biloxi Boat Works
St. Louis, Mo.

(The following five books were suggested:
"Laminated Plastics," by D. J. Duffin
"Silicones," by R. N. Meals
"Polyurethanes," by B. A. Dombrow
"Adhesive Bonding of Reinforced Plastics," by H. A. Perry
"Polymers and Resins," by Brage Golding
—Editor)

• • •

High-Heat Plastic Material

Dear Sir:

I am writing to obtain information on the availability of a plastic material in sheet or bulk form that could withstand a heat of 600° F. Other factors are high tensile strength, low shrinkage, and last, but not least, give off no fumes, toxic or otherwise, while under heat. This material, if manufactured, will be tested as an insulation for gas and electric ovens.

S. A. Kaneski, Designer
Cribben & Sexton Co.
Chicago, Ill.

(In his reply, Lee Zukor, our Engineering Editor, recommended Mycalex as a material that answers all his specifications with an exceptionally good safety factor. It is rigid; can be machined; and can be molded on special compression-type presses. Another material in flexible sheet form is prepared from mica and a melamine resin. While this latter material will not quite meet the inquirer's specifications, it is the only flexible material that approaches them.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

PREVIEWS of Next Month

The September issue will feature the following articles:

Measuring Resilience of Flexible Urethane Foams. R. E. Jones, Head of Physics Lab., Paul Hersch, Physicist, G. G. Stier, V-P in Charge, and D. A. Dombrow, Dir. of Labs, Plastics Division, Nopco Chemical Co., N. Arlington, N. J.

A study of foam resilience reveals the importance of two primary factors, polymeric creep and pneumatic damping, which may govern resilience of foam cushions. Each factor is shown to be dependent on conditions inherent in the foam and the method of measurement. A simple, yet accurate, apparatus for measuring dynamic resilience is described.

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Examining the Heat-Distortion Behavior of Plastics. R. Van Cleve, Leader of Plastics Evaluation Group, and R. R. Cosner, Staff Consultant in Mech. Engrng., Research Dept., Union Carbide Chemicals Co., South Charleston, W. Va.

A new and improved test apparatus is described for determining h-d temperatures of plastics materials. The apparatus also indicates the slope of deflection vs. time or temperature as an index of the severity of failure at the h-d point.

•

The Guest Editorial will be: **"Unfair Competition"** by A. R. Morse, Sales Engr., Injection Molders Supply Co., Cleveland, Ohio.

SPECIAL SECTION

What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Extrusion. R. E. Monica, Head of Extrusion Section, Plastics Tech. Service Dow Chemical Co., Midland, Mich.

Items that should be considered carefully include hopper loaders, hoppers, ovens, control panels, scrap grinders, and suitable take-away equipment. This last category can involve flat sheet extrusion, plastic pipe extrusion, extruded shapes, film extrusion, plastic monofilament, wire coating, and blow molding. Proper planning includes thought on what the equipment must accomplish, as well as its flexibility, maintenance, safety, and cost.

•

PT's Comparative Data on 1959 Extrusion Machines.

PT's Classified List of Auxiliary Equipment for Extrusion.

PT's Comparative Data on 1959 Blow Molding Machines.

IF PHENOLICS CAN DO IT, **PLENCO** CAN PROVIDE IT
AND DOES—FOR **BELL & HOWELL**

to mold a
better lens barrel
Bell & Howell specifies

PLENCO

ROLL OUT the barrel. Or roll it in, by rotating in reverse direction. The fine lens, and its threaded barrel molded of phenolics, combine to give you excellent helical focusing of slide-showings with this projector.

It's the Headliner 706 low-silhouette slide projector, a member in good standing of the famous Bell & Howell family of quality photographic equipment. Through use of a 300-watt "short" lamp, occupying far less vertical space than conventional projector lamps, the Headliner is of extremely compact design —only 7 inches high.

Among Plenco's contributions to the production of this dependable performer is the special-purpose phenolic compound specified by Bell & Howell in the molding of the projector's accurate, smooth-turning *lens barrel*. Requirements called for a material that would assure resistance to heat, dimensional stability, and surface hardness and rigidity . . . together with a lasting, eye-appealing lustre. Plenco provided the answer. Like Bell & Howell, many other manufacturers and molders find the answer to their product or production problem in the wide variety of controlled-quality Plenco phenolic compounds. And they find consultation with Plenco technicians a worthwhile preliminary. We invite *you* to take the opportunity to talk with us, soon.

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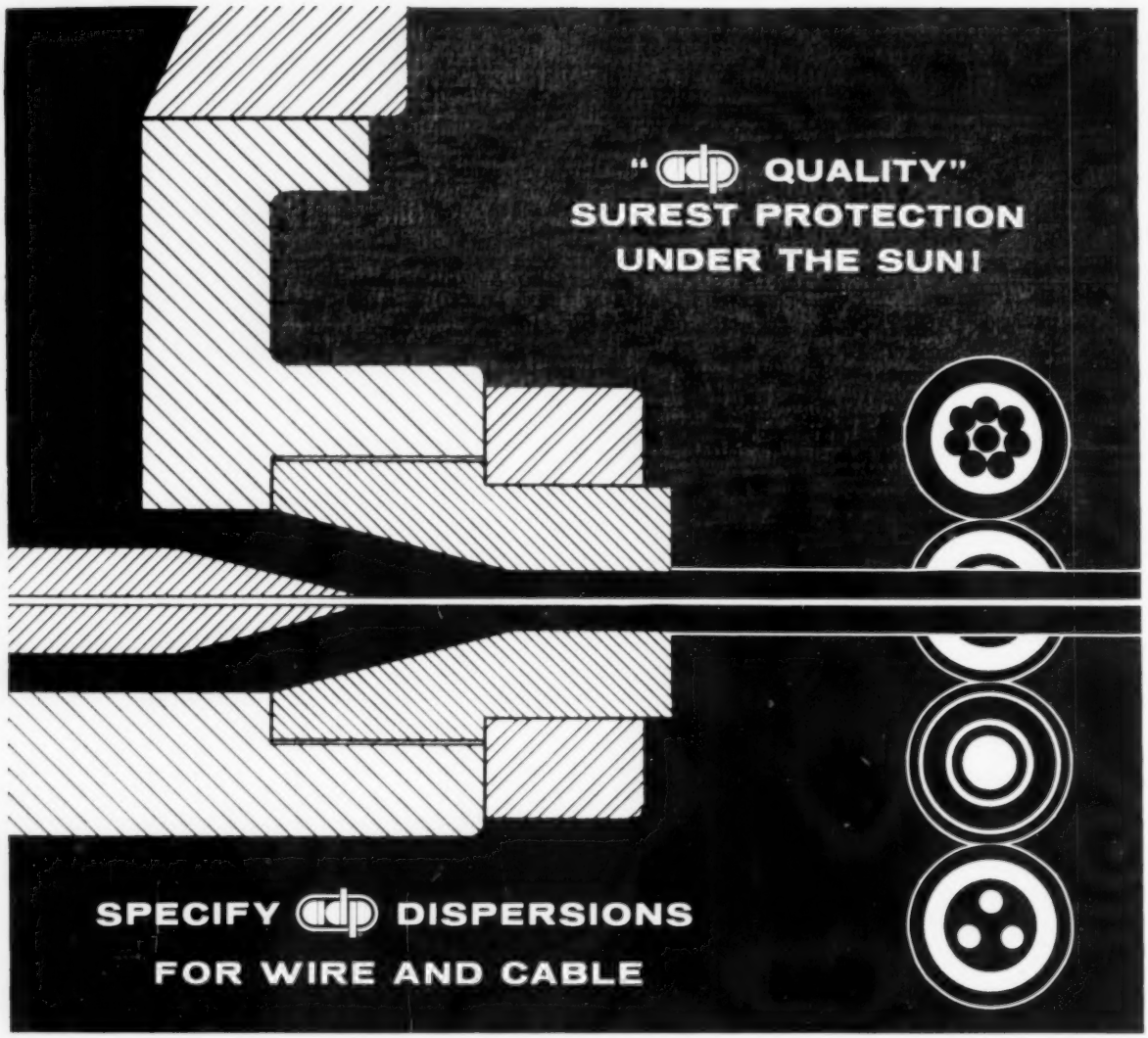
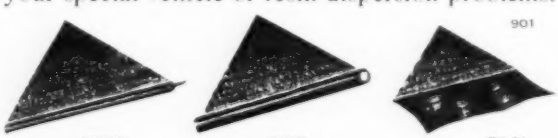
Sheboygan, Wisconsin
Serving the plastics industry in the manufacture of
high grade phenolic molding compounds, industrial resins and coating resins.



Only a uniformly fine dispersion of carbon black can assure year after year protection to plastic insulated wire and cables that are exposed to sunlight. Maximum resistance to harmful ultraviolet radiation depends upon the concentration of carbon black used, its particle size, and the thoroughness with which it is dispersed. Uniform dispersion of microscopic carbon black particles in "ADP Quality" concentrates will control oxidation and subsequent degradation of plastic wire coating giving you the highest product quality.

ADP concentrates of carbon black assure equally superior protection for plastic filament, pipe, and blown or flat film extrusions. In addition to carbon black dispersions in polyethylene, polyvinyl chloride, polystyrene and other resins, Acheson also supplies "ADP Quality" dispersions in electrical code colors. Send for a sample "ADP Quality" dispersion and see the difference . . . or let Acheson specialists work with you to solve your special vehicle or resin dispersion problems.



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QUALITY DISPERSIONS MEAN QUALITY PRODUCTS

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

AUGUST, 1958 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Helpful Hint: We've seen squares of polyethylene film being used to package lemon slices served with iced tea in restaurants.

The covering makes lemon squeezing more convenient and sanitary. It eliminates the problems of sticky fingers and lemon juice stains on clothes, and prevents contamination from handling. Small size tubing cut in proper lengths could be used for the same purpose.

Skim milk powder is being packaged in printed polyethylene bags. The bag holds three pounds of instant milk powder, the equivalent of 12 quarts of liquid milk.

The side-weld, pinch bottom polyethylene bag costs less than conventional foil wrapped boxes now generally used to package milk powder.

Cast polyethylene film made from U.S.I. PETROTHENE resins, is being used with success in two new applications:

A Texas manufacturer is using cast film bags to package tortillas. He reports that the bags are clearer and seal better than conventional wax paper bags. Polyethylene film reportedly provides longer shelf life for the tortillas and has virtually eliminated the problem of stale product returns.

Cast polyethylene is also being used to package hosiery. The clear, high gloss cast film has met with good consumer acceptance. The film is tougher than previous transparent materials used, and returns from damaged packages have been greatly reduced.

Both manufacturers report that use of polyethylene film has significantly lowered their packaging costs.

U.S.I. Wins Three Awards For Polyethylene Promotion

U.S.I. has won three top industrial advertising awards for its 1958 advertising and sales promotion campaign for PETROTHENE polyethylene resins. An important factor in all three awards was U.S.I.'s industry wide promotion of new markets for polyethylene and higher quality standards for products made of polyethylene.

The competitions in which U.S.I. was honored are: National Industrial Advertisers Association Best Seller Awards; The Putman Awards for Advertising Performance; and the American Business Publications Awards.

Imagination Creates New Markets, New Uses For Polyethylene in Sports, Vacation Fields

New Products, New Ideas for Using Film Add to Summer Fun Everywhere

Imagination — on the part of consumers as well as designers and manufacturers — has contributed to a virtually endless list of new uses for polyethylene that have been in evidence this summer.

Utility coverings of polyethylene, available in most hardware and paint stores, make ideal rainproof protection for boats, sports cars, and most anything else that is kept outdoors.

A survey of products designed for the leisure market shows that polyethylene's versatility has created major new sales opportunities in the sports and vacation fields.

Many Marine Applications

Polyethylene's water and corrosion resistance, for example, have been put to good use in products for beach and boating enthusiasts. Boat fittings and bilge pumps are being molded from polyethylene. Bait and fishing equipment boxes made from polyethylene are colorful, lightweight and waterproof. Deck brushes, made completely of polyethylene, including the bristles, do not rot or mildew in damp sea air, are easily cleaned. Ice buckets, thermos jugs, coolers, and picnic baskets are just a few of the great many new leisure time products that capitalize on polyethylene's durability and insulating properties.

Juvenile Market Important

Manufacturers have found that polyethylene serves the juvenile market well. Golf clubs with polyethylene heads, for example, are inexpensive and strong enough for youngster play. Backstops for backyard golf ranges and baseball batting cages are now made of polyethylene film.

Consumers Find New Uses for Film, Pipe

Consumers have thought up scores of uses of their own for polyethylene film.

House plants can be kept for weeks during the family's absence by wrapping them in film. And vacationers have found polyethylene film invaluable when they take it along on trips. As a temporary covering, it can serve for everything from an umbrella in case of showers to coverings for boats, sports cars, camping equipment, and outdoor furniture. It's handy at the beach for wrapping up wet beach clothes or for protecting the car upholstery on the way home. And for the home-improvement vacationer, polyethylene film can protect new lumber, fresh concrete, or even newly planted grass plots.

Polyethylene pipe is also coming into its own for all sorts of easily installed water supply and sprinkling systems.

This Is Only The Beginning

Molders and extruders are just beginning to exploit polyethylene's potential in this market. It gives promise of large volume sales as processors begin to promote its versatility and move it into sporting goods, camp supply, hobby, and do-it-yourself type outlets.

Polyethylene Film Reduces Highway Construction Costs

A Canadian construction company, which has just completed a 180-mile concrete super highway, reports using rolls of polyethylene film, both as a barrier between the fresh concrete and the gravel base, and as an overcovering.

Use of the polyethylene film eliminated concrete leakage into the gravel base, resulting in a seven percent saving in concrete. Slower curing gave a fifteen percent increase in concrete crush strength. The cover film, re-used more than 20 times, also substantially lowered labor costs.

Polyethylene Pipe Helps Form Ice Bridge Across River

In a unique application, cold brine circulating in polyethylene pipe helped form a natural ice bridge across a Canadian River. The "bridge" made possible the passage of trucks with 25-ton loads for a period of three weeks. The ice bridge was built up with water sprayed on top of the pipe to a three foot thickness.

Polyethylene pipe was chosen because of its low temperature flexibility. The "bridge" was removed after use by circulating warm brine through the pipes to melt the ice.

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WITH

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WHEN YOU SHUT DOWN WITH A PETROTHENE® RESIN PURGE

If you extrude or injection-mold polyethylene, you no longer have to put up with rejects or costly scrap when you start up a cold machine. Feeding U.S.I.'s new PETROTHENE® 205-1 special "Shut-Down" polyethylene resin to the machine a few minutes before shut-down minimizes production losses on start-up.

With PETROTHENE® 205-1, such problems as gels, fish-eyes, off-color, and other resin deterioration signs that often show up for hours after start-up will be remarkably decreased. That's because it has been specially prepared to withstand prolonged exposure to high temperature. Thermal degradation is inhibited when 205-1 is held in the machine during cooling and heating periods that follow halts in production.

This special resin is simple to use. A few minutes before shut-down, it is fed to the machine until the normal resin has been purged. Since production at start-up is often usable, there is little or no waste. PETROTHENE® 205-1 is supplied in pellet form, packed in 50-lb. bags.

For more complete details on how you can reduce post-start-up scrap with this special shut-down resin, contact your nearest U.S.I. office, or write:

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99 Park Ave., New York 16, N. Y.
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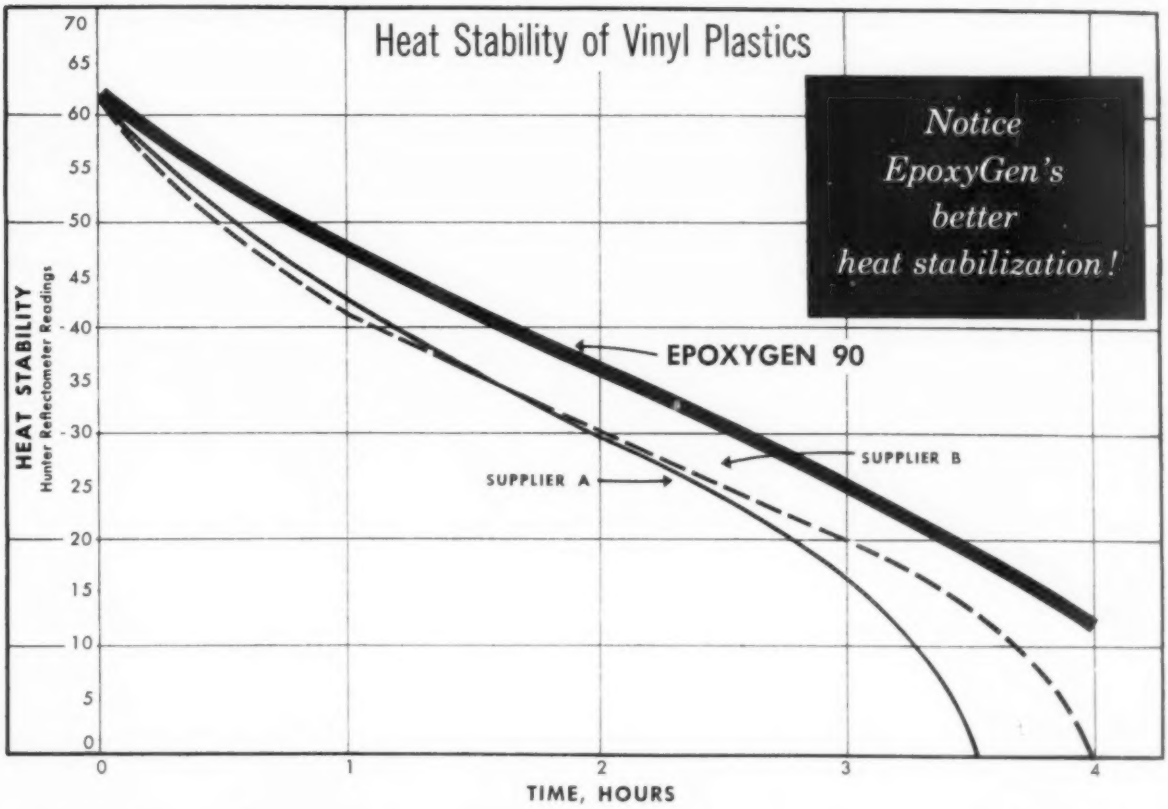
General Mills' new plasticizing stabilizer for vinyl resins sets a new high standard of quality and dependability!



EpoxyGen's® guaranteed high epoxy content makes vinyl plastics 25 to 40% more heat-stable at no extra cost.

EpoxyGen provides up to 10% higher epoxy content than other epoxidized soybean oils on the market today! Its higher epoxy content and inherently better color stability combine to give superior heat stability!

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- *increase your production by operating at a higher temperature*
- *make a higher quality product*

EpoxyGen contains up to 50% less impurities and has 50% lower viscosity. It is available in regular grade *EpoxyGen 80* (85% epoxy*, minimum) or premium grade *EpoxyGen 90* (90% epoxy*, minimum).

*% of theoretical—Basis: Iodine value of starting oil = 130

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- *is more uniform*

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Minneapolis 13, Minnesota

General Mills

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*Patent Pending

IMS **INJECTION MOLDERS SUPPLY CO.**
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Because of Butyrate's brilliant luster, these panels present an eye-catching, eye-pleasing appearance in daytime; and when the sign is internally lighted at night, the sharp contrast of colorful letters with white background gives long-distance legibility.

The low specific heat of Tenite Butyrate makes it an ideal material for sheet thermoforming. With Butyrate there is no need for special preheating oven equipment. Vacuum, air pressure, and mechanical methods are used with inexpensive molds on fast-cycle machines. Available in special weather-resistant formulations and popular sign colors, sheet of Butyrate can also be decorated with lacquers before or after forming.

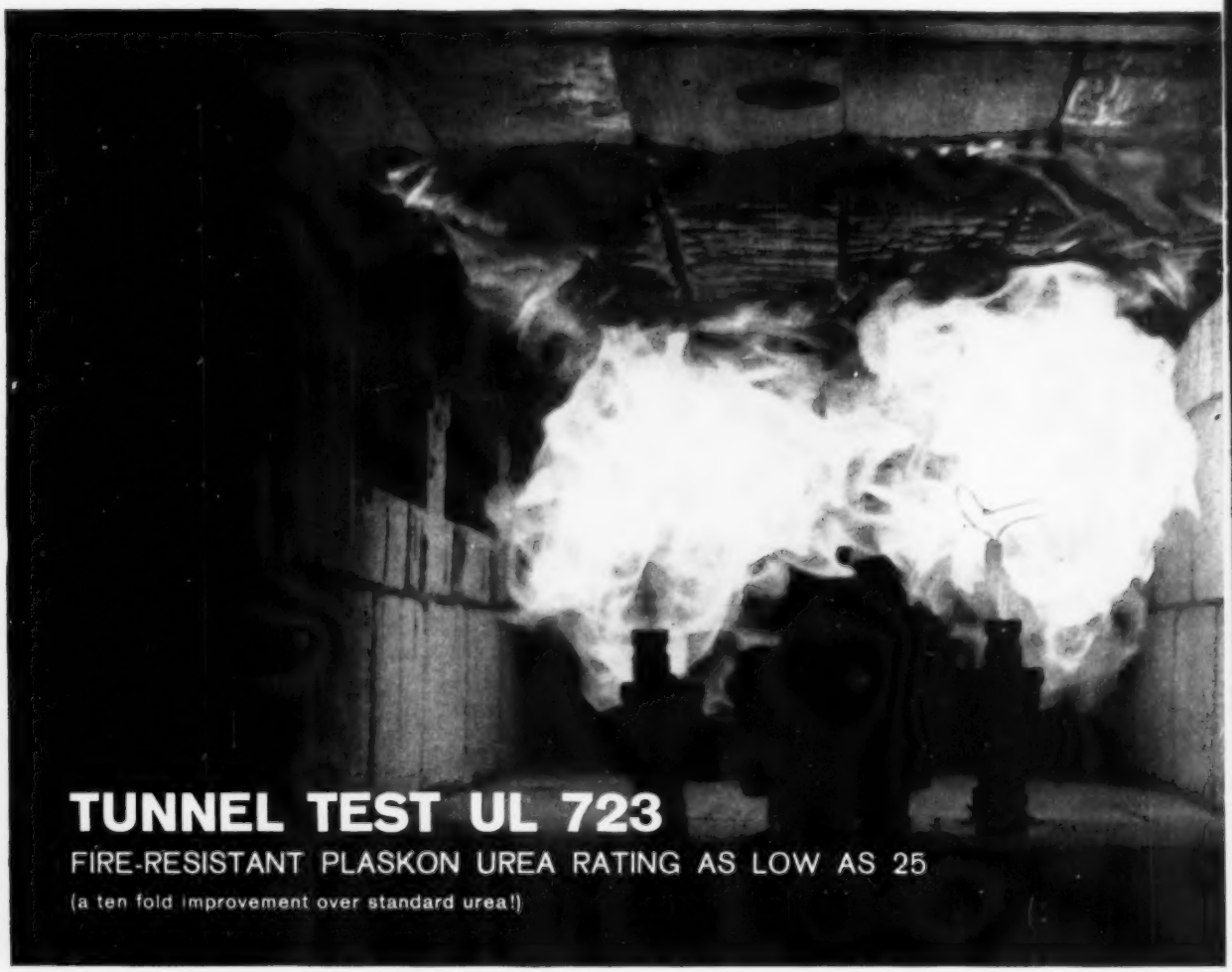
The outdoor sign industry is but one of many to take advantage of the design and production flexibility of Tenite Butyrate. In addition to its possibilities in sheet forming, this tough thermoplastic material can be rapidly injection molded or continuously extruded to serve a wide range of uses—from steering wheels to skin packaging; from tool handles to telephone housings.

When your product needs call for a material that has superior impact and weather resistance, yet is light in weight, lustrous, easy and economical to form or fabricate—consider Tenite Butyrate. For additional information concerning its physical properties and uses, write to **EASTMAN CHEMICAL PRODUCTS, INC.**, subsidiary of Eastman Kodak Company, **KINGSPORT, TENNESSEE.**

TENITE
BUTYRATE
an Eastman plastic

EDCO Tel-A-Flasher signs consist of individual letter panels which can be rotated within their frames to any desired angle. Panels are 15"-diameter or 20"-diameter discs of Tenite Butyrate plastic with raised letters (11" or 15" respectively) vacuum formed into their surface. Manufactured and marketed by Electrical Development Company, 719 E. Madison, P. O. Box 3472, Phoenix, Arizona. Butyrate sheet extruded by Jet Specialties Co., Inc., Los Angeles 63, California.

NEW! FIRE-



TUNNEL TEST UL 723

FIRE-RESISTANT PLASKON UREA RATING AS LOW AS 25

(a ten fold improvement over standard urea!)

PROPERTIES OF PLASKON FIRE-RESISTANT UREA UFR-28:

MOLDING PROPERTIES	ASTM TEST METHOD	FIRE-RESISTANT UREA
Bulk Factor	D392-38	2.4-3.0
Preformability		Good
Temperature, F		275-325
Pressure		2,000-8,000
Mold Shrinkage, in/in		0.006-0.014

PROPERTIES MOLDED	ASTM TEST METHOD	FIRE-RESISTANT UREA
Electrical		
Arc Resistance, sec.	D495-58T	110-130
Dielectric Strength, v/mil	D149-55T	
Short time, ⅛ inch		300-400
Step-by-step, ⅛ inch		200-300

PHYSICAL	ASTM TEST METHOD	FIRE-RESISTANT UREA
Specific Gravity	D792-50	1.47-1.52
Coefficient of Linear Thermal Expansion/deg C, max.	D696-44	2.7×10^{5}
Thermal Conductivity, g-cal/(sec) (cm^2) (deg C/cm)		7.8×10^{4}
Heat Resistance, F, max.		170
Deflection Temperature under Load (Heat distortion), 264 psi, F	D648-56	245
Water Absorption, per cent, 24 hr @ 25 C	D570-42	0.5-0.7

RESISTANT UREA

PHOTO COURTESY OF UNDERWRITERS' LABORATORIES INC.

Plaskon

Today, more and more emphasis is being placed on plastic material possessing high fire retardant characteristics. In response to this critical need, ALLIED CHEMICAL has developed a truly *FIRE-RESISTANT* Urea UFR-28. Where other white and pastel compounds may blister, crack, drip, sag, or readily contribute to flame spread—PLASKON Fire-Resistant Urea effectively meets stringent Underwriters' Laboratories requirements.

In products made of low fire retardant materials, the possibility of "hot spots" arising from overload, long use or any malfunction presents serious fire hazards. PLASKON Fire-Resistant Urea will combat such hazards. Fire-Resistant Urea continues to pass test after test requiring maximum safety. Whether it be a structural or non-structural component for today's products, look to ALLIED CHEMICAL for the thoroughly qualified fire-resistant thermoset compound—Fire-Resistant PLASKON Urea UFR-28 Molding Compound.

A.S.T.M. Test D635-56T
RATING: NON-BURNING

MECHANICAL	ASTM TEST METHOD	FIRE-RESISTANT UREA
Impact Strength		
Izod ft-lb/in. of notch	D256-56	0.25-0.35
Flexural Strength, psi	D790-58T	10,000-16,000
Tensile Strength, psi	D638-58T	5,000-10,000
Rockwell Hardness	D785-51	M116-M120

AND LOOK AT UFR-28's OTHER IMPORTANT PROPERTIES:

- High dielectric strength
- Non-static dust attraction
- Resistance to detergents
- Photometrically controlled color
- Self-supporting rigidity
- Ease of cleaning
- Hard surface, non-abrasion.

PLASKON Engineering know-how is at your service with technical assistance and experience acquired through years of problem solving. A phone call or letter is all it takes . . . do it TODAY!

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40 Rector Street, New York 6, N. Y.
BASIC TO AMERICA'S PROGRESS

Allied Chemical

There are new and better unsaturated polyester resins!

The use of unsaturated polyester resins made with Oronite Isophthalic provides plastics products with greater physical strength with no increase in weight, better resistance features, greater retention of strength and appearance under and after stress and exposure to time, temperature, water, chemicals and weather.

These improvements have been proven in actual experience at reasonable cost and without need for design or process changes. Fiber glass reinforced plastics employing Oronite Isophthalic based resins are gaining wide acceptance in both structural and non-structural equipment and accessories. Other new applications include adhesives, sealing and filling compounds and special coatings.

WRITE FOR bulletin, "Oronite Isophthalic Applications— Unsaturated Polyester Resins." Formulations and resin samples are also available from Oronite for your evaluation. Just contact the Oronite office nearest you.

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5454

PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

AUGUST, 1959

EDITORIAL: What the Steel Strike Can Mean to Plastics

While reading and hearing many reports on the current steel strike, we have been wondering whether the plastics industry realizes that it can be the major benefactor of the eventual strike settlement.

•

In many applications, both in industry and for consumers, that had been eyed by the plastics industry, steel had been the choice because of its favorable price differential, despite the added cost of required tooling and machining of the metal products.

In the past five years, there has been a steady decline in plastics prices. On the other hand, steel prices have been inching up, making more and more of its uses marginal when compared with plastics, aluminum, or other materials. Even at this stage of the steel strike, it is fairly obvious that the final settlement will result in still higher prices for steel. This, in turn, will make even more of its applications marginal.

A major manufacturer of fishing rods and reels has already stated, "If buyers think our prices are too high after a steel price increase, we may switch to high-impact plastics or aluminum!" There have been similar utterances by many other manufacturers of "hither-to-steel" products. In addition, many other non-steel products are in the development-evaluation stage right now, and the developing firms are literally champing at the bit of potential sales opportunities.

In the older usages, especially the large volume types, steel had enjoyed a favorable price differential, but what will happen now? Will steel still be as enticing price-wise? Will its strength still be as necessary when compared with the strengths of polycarbonate plastics or some other properly-reinforced plastic material?

•

Instead of remaining aloof from the steel strike and continuing with business-as-usual, the plastics industry should be using the strike-lull time to study carefully all the steel applications that may warrant replacement with plastics in engineered applications when steel prices rise after the strike.

The time for this study is now while the steel strike is still going strong. The steel strike can have a net result that is very favorable to plastics—if the plastics industry is prepared and ready when the opportunities develop in the steel strike aftermath. Let it not be said later that the plastics industry was napping and missed the boat!

A straight part-replacement of steel by plastic is not always the final answer. The industry should also study part design changes that would be favorable to plastics. Many products of steel have their designs based on steel. Now is the time to determine whether part designs can be changed to make better usage of plastics in addition to the cost angle.

Arthur M. Merrill
Editor

Admex Product-of-the-Month

NEW *Admex 770* BRINGS *Lasting Flexibility*

TO CALENDERED PVC FILM AND SHEETING

Here's top quality performance at a reasonable price. New Admex 770 sets new standards for resistance to extraction and migration—including unusual gasoline resistance and extremely low transfer into rubber.

New Admex 770 is particularly suitable in organosol and calender coated fabric for upholstery applications. Low migration into adhesive masses makes it ideal for pressure sensitive tape and vinyl-metal laminates. Styrene craze resistance and low odor point to use in new refrigerator gasket compounds. Performance far in excess of UL minimums makes Admex 770 excellent for 105° C. wire coating applications.

In comparative tests with other polymeric plasticizers. new Admex 770 scored well on all counts . . . with marked improvement in solvent extraction and migration tests. Technical data and sample quantities of Admex 770 are available. Write today.

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Vinyl Plasticizers

ADM PRODUCTS Linseed, Soybean and Marine Oils, Synthetic and Natural Resins, Fatty Acids and Alcohols, Vinyl Plasticizers, Hydrogenated Glycerides, Sperm Oil, Foundry Binders, Bentonite, Industrial Cereal, Vegetable Proteins, Wheat Flour, Dehydrated Alfalfa, Livestock and Poultry Feeds.

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717 INVESTORS BUILDING, MINNEAPOLIS 2, MINNESOTA

NEWS in BRIEF

Uses of plastics in construction during 1958 are estimated at 709-million pounds, not including 266-million pounds of alkyds and rosin modifications used in paints. The total figure is comprised of 12-million pounds of acrylics for lighting and paints; 66-million pounds of melamine and urea for plywood bonding and high-pressure laminates; 155-million pounds of phenolics for bonding, hardboard, insulation, wiring, and piping; 19-million pounds of polyester for panels and piping; 110-million pounds of polyethylene for wire coating, insulation, and piping; 140-million pounds of styrene for wall tile, insulation, paints, and lighting; and 207-million pounds of vinyls for wire coating, flooring, wall covering, pipe, and lighting. The 709-million pounds represents about 21% of the plastics industry's total production, and is based on both industry and government statistics.

Business developments in the plastics industry continued in the news this month. American Cyanamid's pigments division established a sales & warehousing facility in Charlotte, N. C. Emery Industries moved its sales office from Lowell to Waltham, Mass. H. Kohnstamm & Co. established new headquarters in New York City. Logo Division of Bee Chemical set up West Coast quarters in Gardena, Calif. Foster-Grant Co. is offering an assured price and delivery schedule for colored molding compounds. Skin-Pack, Inc., offers a rental service for its skin- and blister-packaging equipment. A new sales rep. in the Pacific Northeast has been named by Synthane Corp. Dobeckmun Co. moved its branch office in Charlotte, N. C.

Company expansions in plastics are showing the usual summer let-down in number of items. Carlon Products Corp. purchased new plant facilities in High Springs, Fla. Ground has been broken by Claremont Pigment Dispersion Corp. for an addition to its Roslyn Heights, N. Y., plant. A new and larger plant has been occupied by Como Plastics, Inc., in Richmond Hills, N. Y. Dow plans to spend $12-million on new construction for its Louisiana division. The firm also plans to build a polyethylene plant near Fresno, Calif. Escambia Chemical will erect new facilities at Pensacola, Fla. New warehouse has been built by Houghton Laboratories at Olean, N. Y. Modern Plastic Machinery Corp. bought a new plant at Clifton, N. J. A new PVA emulsions plant has been built by Morningstar-Paisley in Clifton, N. J.

New Materials of special interest (see pages 55-58): rubber-base adhesive for vinyl wall tile and panels; protective hand lotion for toxic chemicals; ultra-violet light absorber for polyethylene and polypropylene; synthetic magnesium silicate; two liquid stabilizers for vinyls; six fibers of polyethylene and polypropylene; vinyl-to-metal adhesive; self-extinguishing laminates for electrical uses; intermediate for esters and plasticizers; two-component epoxy repair kit; parting solution and mold release agent; improved acrylic molding powder; flame-resistant paper epoxy laminate; and non-migrating, polymeric plasticizer for vinyls.

New Equipment to be noted (see pages 60-63): high-speed 12/16 oz. injection machine; 8/10 oz. injection machine for large molds and deep sections; line of automated viscometers; electronic embossing-sealing unit; semi-automatic moisture/volatiles tester; and self-contained temperature regulator for water, gas, or steam.

Plastic Applications worthy of attention (see pages 64-67): molded phenolic spigot for corrosive liquids; glass-reinforced plastic bins for heavy materials handling; vulcanized-fiber tote boxes; butyrate gap gage for spark plugs; sanitized polyethylene liner for shelves; high-impact styrene abacus with polyethylene beads; heat-sealing, thin-gage polyester tape; styrene board for water sports; loom shuttle of resin-impregnated cotton laminate; one-piece telephone of molded thermoplastic; and nylon pegboard clip.

DROPPED WITHOUT CRACKING. These 55-gallon drums were dropped from a fork lift. There's no sign of cracking or failure.

Molded by Federal Tool Corporation, Chicago
Drums manufactured by Bedmanson Corp., York, Pa.

Never before possible...

extra-strong giant moldings

BAKELITE Brand Polyethylene DMD-7002
Gives Great Strength and Rigidity without Sacrifice of Appearance

This is the second in a series of notable polyethylene copolymer developments by Union Carbide Plastics Company. BAKELITE Brand High-Density Polyethylene DMD-7002 is an injection molding material with the rigidity and gloss needed for such applications as radio and TV cabinets, appliance housings, and packaging.

IT'S STRONG. DMD-7002 has twice the yield and tensile strengths of DPD-7365, the earlier polyethylene copolymer in this outstanding series.

IT'S RIGID. This high-density polyethylene holds its shape even in large moldings—GIANT MOLDINGS—and it has THREE TIMES the impact strength of conventional high-density polyethylenes!

IT'S ATTRACTIVE. You can injection-mold DMD-7002 into articles with superior gloss and fine details. It offers an excellent combination of strength, colorability, and appearance characteristics.

Try it now—prove to yourself that DMD-7002 has all the advantages claimed for it. Ask your Union Carbide representative or write Dept. HQ-51G Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 7.

TYPICAL PROPERTIES OF DMD-7002

Property	Value
Melt Index, g/10 min.	8.0
Density, g/cc at 23°C.	0.95
Secant Modulus, psi	100,000
Tensile Strength, psi	3200
% Ultimate Elongation	24
Yield Strength, psi	3100
Room Temperature Impact	4.5 feet—No failure
	5.0 feet—60% failure

UNION CARBIDE

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DOW Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

STUDY EMPHASIZES ENVIRONMENT AS IMPORTANT FACTOR IN LIMITING DESIGN STRENGTH (PART 1)

When a designer selects a particular plastics material for a specific end use, he makes his decision based on available engineering data: that is, data relating to the intended performance of the finished part. But too often the data available to him are limited. To assist designers and plastics engineers, Dow has for some time been conducting Plastiatrics studies aimed at developing as complete engineering data as possible on Dow molding materials.

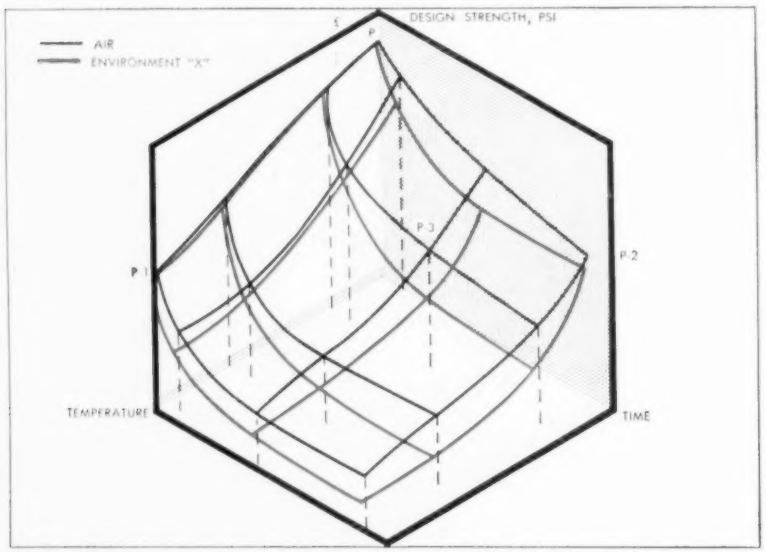
As engineers know, four variables determine the limits of plastics performance — time, temperature, stress and environment (which may be air of varying moisture content, or water, solvents, fumes, vapors, etc.). Yet while it is standard practice to evaluate the effects of time, temperature, and stress, the role of environment may easily be overlooked, even though studies prove it to be equally important in design engineering.

For example, when environment reduces the design strength of plastics below the sum of internal and external stresses, stress cracking occurs — and this takes place in some environments at relatively low stresses, compared to short-time tensile strength. The three-dimensional graph shown here was developed during Dow's Plastiatrics study of the effect of environment on plastics materials. It illustrates to what degree environmental changes may affect the strength of materials, and that the results of evaluating incomplete data may well be misleading.

For example, if readings were taken only at the widely scattered points "P", "P-1" and "P-2", a designer might be justified in assuming that material characteristics in air and in the environment "X" are nearly identical, and that the relationship would hold at other points of measurement. But further testing reveals a considerable difference between the two curves at point "P-3". Here the design strength is found to be substantially less in environment "X" than in air.

Comprehensive data, of the type illustrated in this graph, are being developed through Dow's continuing series of Plastiatrics studies. As the gathering of the data is completed, it will be made available on request, and portions of it will be published in future Plastiatrics articles. Considerable data are already available on several Dow molding material formulations. For information write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 2104DT8.

(This is Part I of a two-part article. Because of the importance of the effects of environment on design strength, no attempt has been made to condense the results of this study into a single article. Part II will appear in a later issue.)



Environmental changes may drastically affect the design strength of plastics materials. The curves plotted here illustrate stress limits of a particular material in air, and in another environment.

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Zerlon*
Ethocel*
Tyril*
Polyethylene
PVC Resins
Pelaspan*
Saran

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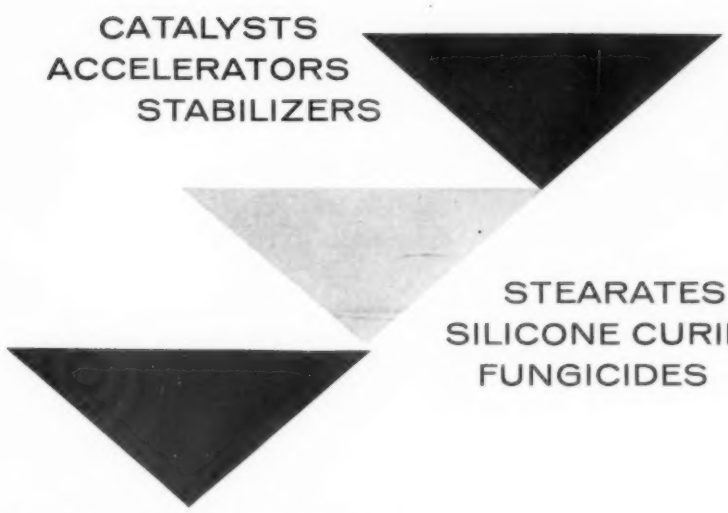
THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN



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Such dependable performance is the result of Nuodex quality control through extensive research and laboratory facilities. And these facilities perform other vital functions for you. They supply experienced technical service and application research to assist you in developing systems to meet your specific needs and to help with practical solutions in manufacturing.

Further, Nuodex research pioneers in the development of new and better products. The most recent example is *Nuostabe V-134*, a superior liquid stabilizer unmatched both in performance and in the range of its applications throughout the vinyl chloride field.

Nuodex representatives all over the United States stand ready to serve you in your special fields of interest. And to assure you of prompt delivery, Nuodex maintains a nationwide network of strategically located warehouses.

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Nuodex offers a complete line of nine *certified quality* catalysts and accelerators for the polymerization of polyester, styrene and vinyl monomers, including Benzoyl, Lauroyl and M.E.K. peroxide catalysts as well as Cobalt accelerators. The growing family of Nuodex vinyl stabilizers now includes 24 different products identified as *Nuostabes*. A broad range of calcium, zinc, magnesium and lead stearates . . . ten silicone curing agents known as Silicures® . . . plus a line of fungicides developed for plastics . . . together give you the widest choice of special purpose chemicals available from one source.

For a complete listing of Nuodex products, see pages 483-488 in your 1960 edition of Chemical Materials Catalog.

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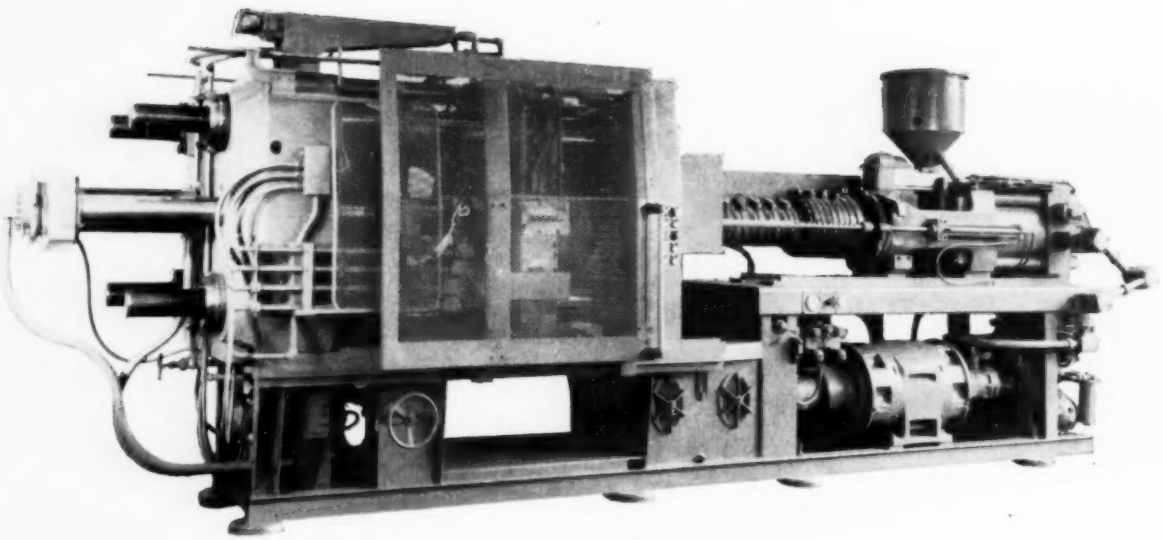
Announcing A NEW "IMPCO"

Injection Molding's Most Versatile Performer!



Impco Model HA16–425

20 ounce injection molding machine

The size of the new HA16-425 "Impco", combined with its speed and adaptability, make it Injection Molding's most versatile performer! Seven hundred and twenty dry cycles per hour at full 24½ inch stroke — two hundred pounds per hour plasticizing capacity — hydraulic knockout — live adjustments, are but a few of the many features contained in this machine. Let us show it to you.

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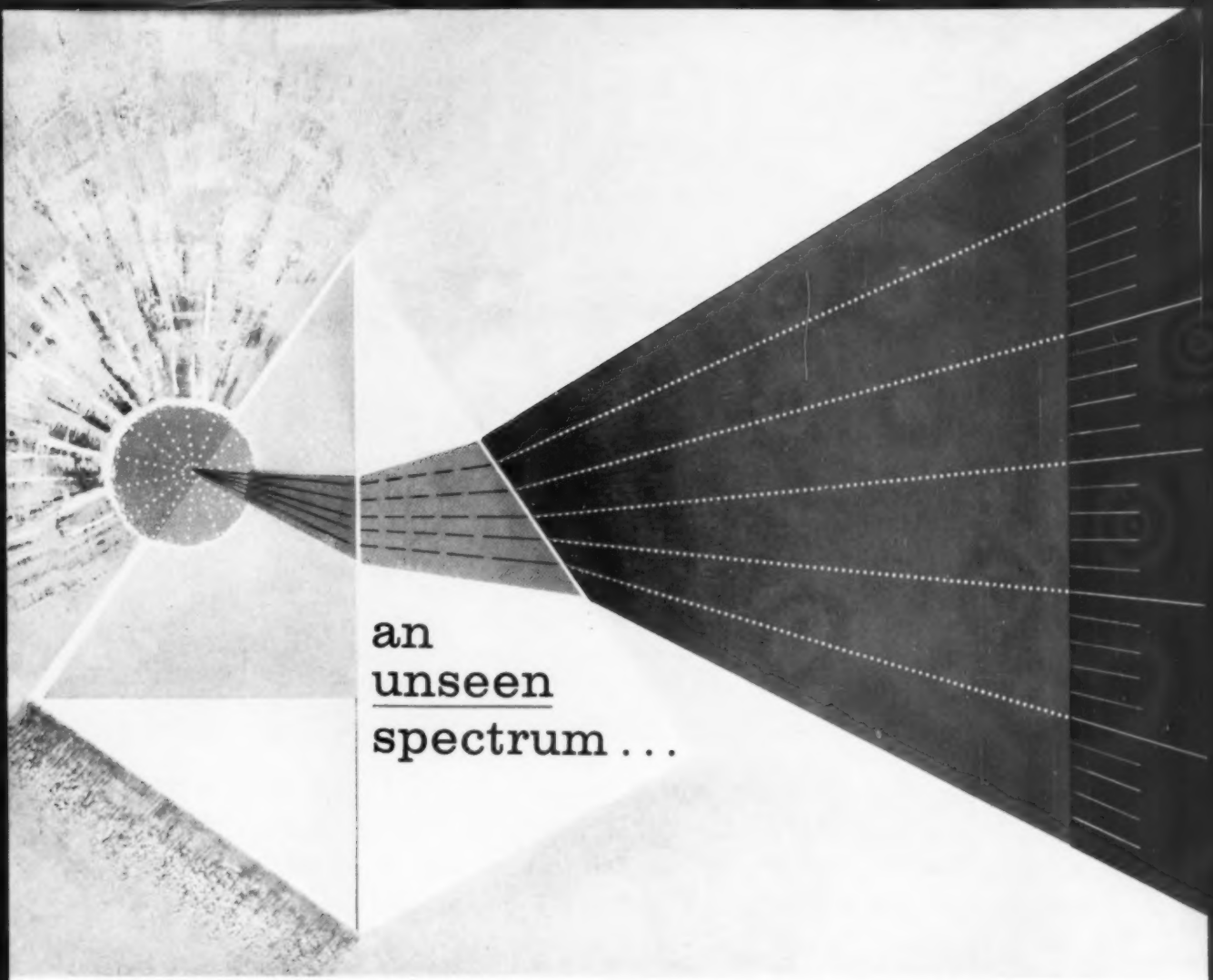
NASHUA, NEW HAMPSHIRE

In Canada, Sherbrooke Machineries Limited, Sherbrooke, Quebec

Export Distributors: Omni Products Corp., 460 Fourth Avenue, New York, New York



proves CYASORB* Light Absorbers to be the best protection against sun damage!

A 1/2" strip of potent darkness is the exciting end result when sunlight passes through the special mirrors, lenses and prisms of the Heliostat. It is the ultraviolet spectrum, carefully screened and continuously measured as it is projected onto plastics and other sun-sensitive materials to determine the degradative effect of each ultraviolet wave length on sun-sensitive products — and how CYASORB Light Absorbers can protect them.

As it tracks the sun through the sky, the Cyanamid-developed Heliostat is revealing new and useful information on light-degradation mechanics. Aid to formulators in the selection and dosage of CYASORB Light Absorbers is one benefit. Another is the screening and evaluation of new ultraviolet absorbing compounds as part of Cyanamid's continuing research in this field.

Polyesters, for example, were found through Heliostat investigation to be particularly susceptible to the 325 to 330 millimicron wave length range. Cyanamid researchers are making similar studies to determine the degradation characteristics of POLYVINYL CHLORIDES, POLYSTYRENES, POLYETHYLENES, POLYPROPYLENES and other plastics systems. These experiments enable us to pinpoint the CYASORB Light Absorber, commercial or experimental, which will give your product maximum protection.

If you have a light-sensitive product, let Cyanamid's research experience point the way to efficient protection and outdoor markets. From the Heliostat, the Fade-Ometer, Weather-Ometer and outdoor rack testing, Cyanamid has developed the practical information that make CYASORB UV 9 and CYASORB UV 24 the most effective ultraviolet absorbers available today. For further information on CYASORB Light Absorbers, please write on your letterhead. *Trademark

AMERICAN CYANAMID COMPANY
Organic Chemicals Division • Intermediates Department • Bound Brook, New Jersey

CYANAMID

● We see no reason to keep under this reinforced plastic hat the fact that Reichhold sells a QUALITY LINE OF POLYESTER RESINS for every type of product and manufacturing procedure. For full information on RCI's versatile polyesters, clip and mail the check list below. Technical information will be sent to you promptly.

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of the company indicated on this letterhead.

Please send me full technical information on the use of RCI POLYLITE Polyester Resins for:

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☐ Corrugated and Flat Sheet	☐ Structural Lay-up	☐ Encapsulating

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Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate
Sulfuric Acid • Methanol

REICHHOLD

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N.Y.

VINYL

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IN ALL FORMULATIONS FOR CALENDERING • EXTRUDING • MOLDING

Introduces New Controls in an Inexpensive Liquid Stabilizer

For the first time

performance variations due to resin or plasticizer or filler are minimized...

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THE INDUSTRIAL SUN never sets on the worldwide acceptance and application of Welding Engineers' patented dual worm equipment and its continuous output on plastics and rubber production lines with the greatest quality responsibilities. We like to think of these pioneering production lines as *progress lines* extending like great industrial meridians across the continents, the Americas, Europe, Asia and Australia . . . keystoned with WEI custom-fitted dual worm compounder-devolatilizer-extruders that set the competition pace with the optimum in rate, quality and flexibility.

Who gets the credit for this label of leadership? We believe that the pioneering fortitude of our customers *in the research and manufacturing fields of plastics creation* deserves the greatest credit. This confidence has strengthened the Welding Engineers organization and identified WEI dual worm equipment as one of the most potent production tools in the industry.

May we show your key people how carefully we interpret our customers' compounding-devolatilizing-extruding needs in all-in-one-operation machines? Today—WEI dual worm equipment has a better-than-ever chance to make a big profit difference in your own contribution to worldwide plastics!

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NORRISTOWN, PENNSYLVANIA

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Specialists in the Development and Manufacture of Continuous Operation Dual Worm Compounder-Extruders

PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

Studying Extrusion Flow Lines

New techniques and results obtained on flow paths followed by molten material during extrusion.

L. F. STREET, *Mgr. of Marketing*
Welding Engineers, Inc.
Norristown, Pa.

IN order to develop additional information as to the flow paths followed by molten material while being advanced by an extruder screw, tests were conducted by processing a multi-colored feed of cold granules in a plasticizing extrusion operation. After obtaining a stable extrusion operation, the machine was stopped under full load, the screw was removed, and the material in the screw channel observed. Samples also were taken of the multi-colored product at the die.

Test Procedure

The tests were performed on a two-inch extruder having a length to diameter ratio of 20:1. The screw channel was ¼-inch deep, having a two-inch lead from feed hopper to the metering section. The metering section was the length of three flights, still two-inch lead, but 1/16-inch deep. Wrap-around taper occurring in 180° formed the transition in depth from ¼- to 1/16-inch. The barrel was heated electrically, with no provision for cooling on either barrel or screw. Barrel temperatures for all runs were approximately 135° C. at the rear (feed) end, 190° C. in the middle, and 195° C. at the discharge end. Screw speed was 49 revolutions per minute. Die having a sloping approach to a ½-inch diameter orifice was used. Die temperatures were 195-200° C., and the product temperature was 185° C. The output rate was 60 pounds per hour.

Test Results

Interesting results were obtained in the first run. Samples of the extruded rod were cut at the die, cooled, and then cut longitudinally. Three of these samples from two different runs are shown in Figure 1. The arrow indicates the direction of flow out of the die. Upper and lower samples are cut along the centerline. The middle one is cut for most of its length on the centerline, then the cut surface slowly curves up to the surface or O. D. at the extrudate. A characteristic surge or impulse with a wave-like form is to be seen about half-way from the axial centerline to the O. D. of the rod. The material occupying this portion of the rod is the material most recently extruded, as was determined by the colors.

The wave form in the lower specimen of Figure 1 is a mixture of red and white, whereas the zig-zag cen-

ter portion is green and a thin film of green remains at the O. D. of the rod. The relatively stagnant material in the center and at the O. D. seems to result from the normal stream-line flow to be expected in a die. The central material comes from a reservoir formed at the tip of the flat-end worm, and the material at the O. D. is that which clings to the die surfaces. The central and outside materials are better mixed than the material included in the wave or surge; that is, it gives to the eye a more uniform color effect which undoubtedly results from the prolonged shearing effect and stretching out of the material into very thin layers as the stagnant material is pulled away slowly and new material occupies that space. Then, this new material also is drawn out.

The central sample in Figure 1 was taken a few minutes after the lower one during the same run. The green material which occupies the central and O. D. positions of the lower sample has been displaced entirely; the O. D. and central areas now being filled with the red and white mixture, and the surging wave form being made up of a black and yellow mixture. The red and white mixed feed is an almost-uniform pink in the central sample, and is mixed much better than the red and white in the lower sample where it occurs in the wave. In the central sample, the black and yellow material in the wave is mixed coarsely, as is the red and white wave in the lower sample. Inspection of the sample ends shows a considerable increase in the proportion of black and yellow feed in the rod in the short length equivalent to about five turns of the screw. (In both of these specimens, there are shrinkage holes from too-rapid cooling.)

This wave of freshly-extruded, rapidly-traveling material is present in the extruded rod in the form of a helix. Evidently, this is deposited in the reservoir of material in the die by high-pressure forwarding of material in the worm as it rotates. The material is deposited in a manner similar to forming a wound spring. However, the material being liquid, it has peculiar flow properties—some of which are indicated in these samples. A possible explanation for the peculiar shape of the wave will be given later.

The third specimen (upper) is taken from another run, and was prepared in the same manner as the other two. Other samples and clear rods were extruded and, when colored feed first appeared in the clear rod, it appeared in the same part of the rod as the wave surges. These tests were performed with commercial polystyrene.

Screw-Channel Flow

To obtain samples of material from the screw channel, the screw was pulled immediately after shutting down the machine. After removing the screw, the material was unwrapped from the screw channel while still hot, and this became the sample ready for observation. By cutting through the specimen, flow lines along various planes could be observed.

Figure 2 illustrates sections of material on a plane across the channel perpendicular to the flight and perpendicular to the screw stem. The pushing face of the flight is on the right. Lines of the cross-channel flow

Louis F. Street was born in Rochester, N. Y., in 1909. He joined Welding Engineers, Inc., in 1942 as a member of the firm's Engineering Department, becoming Assistant Research Engineer in 1944, and Chief Research Engineer in 1948. In 1952, he transferred to the company's Sales Department, and in 1958 was named Manager of Marketing, his current position. He also is Chairman of the firm's Patent Committee, and holds several U. S. patents on extrusion. Lou Street is a member of SPE, and is active in the Society's Extrusion P.A.G. With all his professional activities, he has retained his interest in painting as a hobby, and is a member of the Norristown Art League.

Mr. & Mrs. Street have two daughters (aged 17 and 15 years), and make their home in Norristown, Pa.

can be seen plainly. In the operation shown by this sample, it is clear that the most rapid rate of cross-channel flow was a little above the middle, with the material flowing upward toward the barrel surface at the left side, and flowing down at the right side, preparatory to flowing across the channel again. (Actually, the material near the bore surface is relatively stationary, while the flight has an apparent motion forward.) This was made from a feed of mixed red and white polystyrene. The upper sample was cut a short distance downstream from the point at which full plasticizering occurred. The lower sample was further downstream near the metering section.

Down-Channel Flow

Figure 3 shows sections cut parallel to the flight. This is taken from the same run and is from the immediate vicinity of the samples in Figure 2. The specimens were taken from the corresponding vicinities shown in Figure 2. In both Figures, the lower surface of the specimen is next to the screw, and the upper surface is next to the bore. The axial flow in the upper sample is less smooth (probably due to the fact that there are appreciable differences in temperature and viscosity at that point). Further down the channel, as in the lower sample, the flow lines are smoother, due to more uniform temperature and viscosity at this point. (The large scale separation of the red and white materials in the downstream sample in Figures 2 and 3 is without significance. It reflects merely a large segregation in the feed.)

A study of these samples gives a visualization of the

two concurrent flows which are occurring simultaneously; cross-channel flow, and down-channel flow. Other tests were run to obtain samples that would show the over-all flow of which the above are two components.

Total Extrusion Flow

It was found that feeding a small percentage of colored pellets in clear material gave samples which offered great promise of further clarification (see Figure 4). With this sample, it is possible to look entirely through the specimen and obtain a total picture of the action. Of course, the lines shown are swirling around from deep in the specimen and up to the surface (which does not show in the illustration). Furthermore, in interpeting the significance of these lines, it must be borne in mind that the material flow in some portions of the channel is not parallel to these lines, but is at an angle to the tracer lines in the specimen, often at 90°.

Clear polystyrene was fed to the machine for 12 minutes to stabilize the operation, and then a mixture of clear material with 1-3% colored pellets was fed for 1-3 minutes. Following this, the machine was stopped and the screw pulled. Numerous additional tests, besides the one shown in Figure 4, were made using a variety of colors as tracers. These clearly showed the material moving down the channel in a rotating vortex-type pattern. Many flow lines could be traced of the flow across the lower part of the channel. From there the material curves upward (toward the barrel surface) and, at the same time, its rate of travel toward the discharge considerably increases, when conceived in a down-channel sense. It would be expected that many of the flow lines would become the equivalent of circumferential lines representing their stationary position against the barrel. However, because of the screw-removal technique used, these lines were distorted and became axial instead of circumferential. In the work done by Maddock (1)*, the circumferential lines on the outer surface of the material are plainly visible.

The swirling lines of this sample (Figure 4) indicate the zig-zag course the material follows in its progress toward the die. It is interesting to note that when the material is flowing most rapidly across the channel, somewhere near the mid-point in depth, it is approaching the die most rapidly in directly-measured axial distance from the die, but is progressing very slowly along the channel. When the material is close to the surface of the bore, it is moving slowly in relation to the bore. It approaches the die very slowly in a direct axial direction, but moves rapidly down the channel, or rather the channel is moving rapidly past it. Thus, when a particle is moving most rapidly toward the die in an axial direction, it is moving slowly in a down-channel direction; when it is moving rapidly in a down-channel direction, it is moving slowly toward the die in an axial direction.

An unusual and unexpected phenomenon also was observed. In several places, it could be seen plainly that a flow across the lower part of the channel had occurred. But when the material started to rise to a higher level in the channel, it curved back toward the

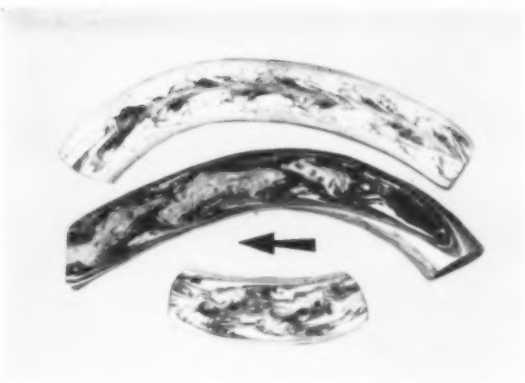

Fig. 1. Three specimens from two different extrusion runs. Arrow indicates direction of flow through extruder.

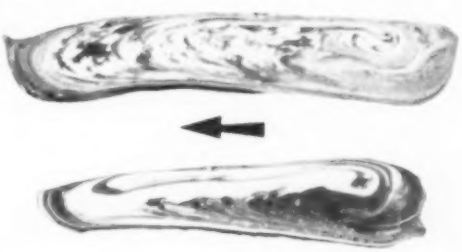

Fig. 2. Extrudate sections on a plane across the channel, perpendicular to the extruder flight and screw stem. Arrow indicates direction of flow through extruder.

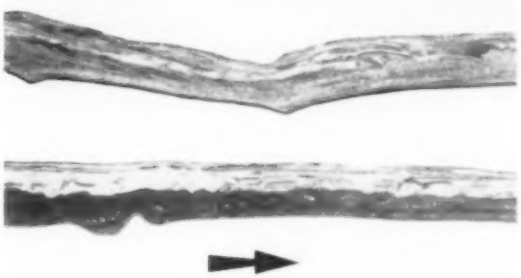

Fig. 3. Extrudate sections cut parallel to the screw flight. Arrows indicate direction of flow through extruder.

Fig. 4. Extrudate sample showing total picture of flow action. Arrow indicates direction of flow through extruder.

* Numbers in parentheses refer to Bibliography at end of article.

feed hopper, or at least moved forward more slowly than the surrounding material instead of curving toward the discharge. The only conclusion derived so far from this study is that the lowered screw efficiency, caused by the back-pressure, exerted its greatest influence in this area; i.e., slightly above the root of the screw and in the half of the channel closer to the back face of the flight. It is felt that this phenomenon may have a relationship to the distorted isovels found by Eccher and Valentinotti (2) with an increase in back-pressure.

Long Flow Lines

Although the above technique proved very useful in showing certain flow lines, it seemed to reveal short flow lines only. Accordingly, another technique was attempted to determine the possibility of disclosing the long flow lines.

This consisted of filling the machine and stabilizing the operation with clear material; then feeding in a solid color which was timed by experiment to reach a certain distance into the machine; and finally pulling the screw as before. This gave some of the most interesting results obtained, and fulfilled the expectation of showing the nature of the long flow line.

Figure 5 illustrates some samples obtained in this manner. The central sample shows solid white feeding into clear. This dramatically illustrates the area of most rapid advance. The material is flowing round and round, as shown in Figure 2, and the most rapid advance toward the die occurs generally in the portion from the mid-channel and outward, somewhat closer to the pushing face of the worm flight. (Confirmation of these estimates of position in the channel is required by additional tests, particularly tests which eliminate the distortion caused by drawing the screw through the bore immediately on shut-down.)

The upper and lower samples were prepared by feeding the extruder 50 grams of white material, after stabilizing the operation with clear plus a color tracer, and then feeding clear with another color tracer. It can be seen plainly, especially in the lower sample, how the clear with the black tracer is entering into the white with a flow similar to that in the central sample.

Figure 6 illustrates the appearance of transverse sections of the central and lower specimens of Figure 5. The rapidly-advancing material was found to be in long, thin, sheet-like layers curving around on themselves. As can be seen in the illustrations, the new and old materials would form layers and, as the new material advanced, the number of layers would increase. The old material is pushed forward until the new material fills the channel with the same type of rotary, laminar flow occurring, although it is no longer visible.

The new material furthest advanced would be three or four turns of the screw-channel ahead of the bulk of the material which was almost filling the channel. A thin layer on some of the screw-channel surfaces would take a long time to flush out.

Nature of Flow

In all of these tests, either where a color was entering into clear or clear entering into color, the laminar nature of the circulating flow was observed. Initially, a thin, curled sheet of the new material would project forward. About one turn or more of the screw further back, two layers; then, three layers a little further back, and these layers would then increase rapidly. From one pair of comparative tests, it seemed that the further downstream the study was made of the new material penetrating into the old, the more elongated and stretched out was the point of the penetrating new material.

It also was observed that a space about ¼-inch wide, next to the pushing face of the flight, was slower to make the color change than might be expected. On the other hand, a thin film of new material seemed to advance rather quickly along the entire width of the root or stem of the screw (probably without displacing a thin film of old material which still coated the screw) by some mechanism that is not yet understood. This new material advancing along the root of the screw was paralleled for about one full circumference by the portion where the old material completely filled the ¼-inch space against the pushing face of the flight.

The nature of the circulating flow would seem to offer an explanation for the shape of the wave form in the extruded rod. As the screw tip rotates past a given point, the pressure forces plastic out into the die reservoir. As the screw continues to rotate, the pressure forcing the material forward rises due to the fact that the hydraulic pressure near the pushing face of the flight is higher than that near the back face of the flight. The higher pressure near the pushing face of the flight results in a larger deposit of material in the die reservoir just before the flight passes this hypothetical point of observation. As the flight passes, extrusion at this point stops, to be resumed with the next revolution. The shape of the wave form in the extruded rod indicates that this may not be a constant cross-channel pressure gradient, or at least does not produce the form of surge that would be expected from a constant pressure gradient.

Interesting observations also were made of the plasticizing zone of the extruder. Early tests indicated that as the material plasticized against the hot surface of the bore, it was collected against the pushing face of the flight. As this material continued to collect, it circulated around and around in a manner similar to that shown in Figure 6, but filling only a part of the width of the screw-channel from the pushing face outward. This starts as a very small amount and grows further and further across the channel, apparently at a uniform rate, until it touches the opposite side. The channel is now filled with plasticized material and the initial plasticizing has been completed. Of course, some granules may not be completely melted down as yet, but they are contained in a plasticized matrix. This plasticizing action occupied a length of the screw equal to four or five diameters.

In Figure 7, a top view and a bottom view of adjacent portions of this plasticizing action are shown. The lower sample is taken immediately forward of the hopper, and shows the surface touching the bore. The

upper sample is adjacent to the lower one in the machine, and shows the surface touching screw stem.

Figure 8 gives an end-view of one of the two samples shown in Figure 7. This clearly indicates a condition which might be divided into three different stages. The first stage is fully-plasticized and already fairly-well mixed (this is the material that has been working against the pushing face). The second stage is a border zone where pellets are just beginning to plasticize; they are distorted far from their original shape, but the borders of each pellet still are clearly visible. The third stage is the unplasticized pellets. The pellets clinging to this specimen were plasticized sufficiently on the surface so as to stick, while further out in the channel most of the pellets fell away on drawing the work (some stuck lightly to the worm surface).

It further was observed that the pellets moved forward much more rapidly along their portion of the channel than did the plasticized material. This was checked by feeding in small batches of different colors just before shut-down so that these colors still would be in the plasticizing zone. This very graphically demonstrated the higher rate of travel of the pellets. Unfortunately, black-and-white photographs of the color samples do not bring this out and so they are not included here.

In the plasticizing zone, the new material advanced very rapidly along or very close to the screw-root surface. There was also a rapid and almost complete flush-out of material in the plasticizing zone.

Need for Future Tests

The relatively limited number of tests performed gave much insight into the material flow in an extruder and indicated that a wealth of additional information could be obtained, such as the feeding of solid color into clear for periods from 20 or 30 seconds for some tests, and up to several minutes for others, to determine the initial, intermediate, and long-term penetration of new material into old.

In one test, for example, the machine was stabilized with black and then other colors were fed for 10 minutes. A continuous thin film of black was found on the sample strip, starting in the lower radius of the pushing flight, moving out at the end of the plasticizing zone into a wide band on the stem of the screw, and slanting across to form a narrow band in the lower radius of the flight's back face toward the downstream end. Also, the feeding of different proportions and mixtures of tracers in clear, and the feeding of different solid colors, one after another, promises to reveal still more about the extrusion process. Test samples prepared under a variety of back pressures should be enlightening.

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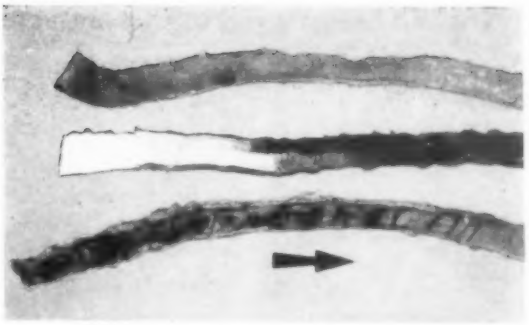

Fig. 5. Extrudate samples showing nature of long flow lines. Arrow indicates direction of flow through extruder.

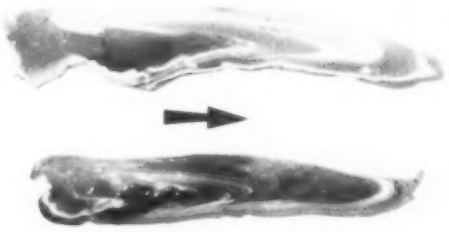

Fig. 6. Transverse sections of samples shown in Figure 5. Arrow indicates direction of flow through extruder.

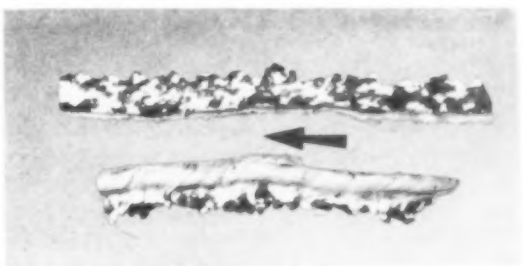

Fig. 7. Top and bottom views of adjacent portions taken from "plasticizing action" area of extrudate. Arrow indicates direction of flow through extruder.

Fig. 8. End-view of lower specimen shown in Figure 7.

Guest Editorial

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Decorative Plastics Laminates in the Home

THERE is no guarantee of success in today's rapidly changing economy. We believe that success in the thermosetting plastic laminate field depends to a great extent on research and development, as measured by our past history. We know, for example, that it is not enough to develop a product, produce it in standard-sized sheets and give it wide distribution.

What success we have enjoyed can be attributed also to our emphasis on research and development—not alone in terms of improved product, but also in terms of ideas for using the product. Plastic laminates will be as basic in residential and commercial building as wood, steel, wallpaper, and paint in the near future. That day is as close as our industry cares to make it. No single producer can do it alone! Our entire industry should contribute time, energy, and money to research and development to make that day, tomorrow.

How many things have been looked upon as quite impossible until they were actually accomplished? Research never embraces the idea of impossibility. We recall when we developed "good old" black phenolic sheet for radios. This was then the biggest decorative laminate seller. Then came melamine laminates . . . gravure cylinders . . . new printing techniques (such as our "marble" Milano) . . . methods of sizing and treating . . . new materials . . . developing inlaying processes. These developments, and many others, were significant advances in terms of improved products. Such developments must be balanced in terms of product application, an area often overlooked by many in our industry today.

Since World War II, the decorative plastic-laminate industry has become an increasingly important factor in building due to the development of desirable colors and patterns embodied in a material with built-in durability and ease of maintenance. But having the product for the booming building industry was not the sole reason for our growth. We knew that in order to grow, the applications of our material had to be increased. We developed the Vanitory. Today, we know that almost 35% of all lavatories sold by plumbers are for installation in bathroom vanities. Not all of these use laminates, of course, but a good percentage is surfaced with decorative laminates.

The emergence of the kitchen as more than just an area for meal preparation and dish-washing encouraged us to bend our application development to that room. Plastic laminates already were accepted for sink-tops; we developed the concept of laminates for all counter tops, for back-splashes, and ultimately for cabinet fronts and the walls themselves. The housewife, having plastic laminate sink-tops, understood and appreciated what this gave her in terms of attractiveness and ease of cleaning. But she had to be told and sold on the idea of putting these same features elsewhere.

Now let us look at the importance of research and

(Continued on page 34)

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Production Problems With Polyurethane Foam

Problem areas in the production of polyurethane foam are discussed along with their alleviation.

THE production molding of polyurethane foams differs from the production of almost all other plastic parts. Many molded plastics can be made meticulously uniform from day to day once the preliminary problems have been overcome. Polyurethanes, however, usually do not lend themselves to this kind of uniformity, especially when there are corners, contours, thick sections, and very thin sections all in the same piece.

Starting Materials

The main difficulties in molding polyurethane foams, especially the polyether types, can be traced to the complex nature of the starting materials. Polyethers commonly used for the polyurethane prepolymers are made by an oxide addition reaction whereby an alkylene oxide is reacted with a dihydroxy compound (such as propylene glycol) in the presence of an alkaline catalyst and in a nitrogen atmosphere to form a polyoxyalkylene glycol (polyether).

These polyethers are tangled masses of long- and short-chain macromolecules that may vary widely in molecular weight distribution, and may contain cyclic structures, an occasional double bond in place of a terminal hydroxyl group, some residual catalyst, some chemically-bound water, or-some volatile or non-volatile oxidation products (such as aldehydes and acids). These things individually or accumulatively do exert profound effects on the moldability of a foam from batch to batch, or sometimes in the same batch from hour to hour. Thus, when different batches of prepolymers having the same chemical structure, the same viscosity, and same isocyanate (NCO) content vary in the type of molded foam texture, part if not most of the trouble might well be found in the control of

the reaction that produced the polyether.

Too high a reaction temperature; too high a catalyst concentration; laxity in blanketing the reaction zone with nitrogen; the presence of moisture or air in the nitrogen; moisture and impurities in the alkylene oxide; and improper removal of catalyst all will contribute their share in making a polyether foam play tricks on the production foreman or chemist charged with the responsibility of maintaining high production standards.

Polymer Reactions

There are various other sources of trouble aside from the ones inherent in the polyether. A polyether first must be made into a polyether-urethane before formation of a foam can be achieved. This involves a chemical reaction of the polyether with a diisocyanate. The diisocyanates most commonly used are tolylene diisocyanates that contain two isomers of different reactivity. If these isomers are not present in the same ratio from batch to batch, difficulties will develop.

Furthermore, these diisocyanates usually contain an hydrolizable acid chloride impurity (e.g., the carbamyl chloride). If this is present in too high a concentration, it will have a deleterious effect on the character of the foam by acting as inhibitor to retard the reaction producing the foam. On the other hand, this so-called "impurity" has a stabilizing action and, if not present to some degree, the cross-linking reaction may be premature and the prepolymer as well as the foam is likely to be affected adversely.

In the presence of the carbamyl chloride and the right isomer ratio, a properly-balanced chain propagation will occur. This means that the reaction will proceed first in a linear direction with the formation of urethane linkages, followed by a gradual cross-linking of these chains with simultaneous evolution of carbon dioxide and formation of urea and allophanate linkages in ratios conducive to good aging and good cell structure properties.

Emulsifier

Another ingredient vital to the production of good foam is an emulsifier. This, being a surface-active agent, renders the polyether-urethane a more receptive medium for solubilization of the catalyst and water. Without this ingredient, a coarse foam results and the reaction rate may be retarded. If this emulsifier is present in too great an amount, it may cause foam collapse or act as a plasticizer to produce a soft, soggy foam.

The most widely-used emulsifiers have been organic silicone oils that were not soluble in water and had to be added to the prepolymer, rather than to the catalyst system. When drums of polyether-urethane prepolymer containing silicone oil are stored for a month or so before use, the silicone oil, if not redispersed by mechanical agitation, will migrate to the surface and many headaches for the production foreman will result.

Mold Temperature

Another difficulty in large-scale production of molded polyether-urethane foams arises from variations in mold temperatures. Mold temperature affects viscosity which, in turn, influences degree of crawl (filling-in of all corners, contours and crevices of the mold), rate of cure, and character of the foam. A high mold temperature may reduce viscosity to a point where the gel stage will not be reached until a large portion of carbon dioxide gas has escaped. Underfilling of the mold and cell collapse, especially in the thinner sections, may result.

A low mold temperature, on the other hand, will extend the curing cycle. Keeping molds coming into the pour station at constant temperature and maintaining an initial viscosity of around 8,000-11,000 centipoises in many cases will eliminate the three aforementioned production problems.

Conclusions

This article is meant only to point out some of the hidden sources of trouble which plague operators and production people in plants producing polyether-urethane molded parts. It in no way is a complaint against suppliers of polyethers and polyether-urethanes, and it is written with the full realization that many of the unpredictable molding difficulties in manufacture of urethane foam materials rapidly are being eliminated.

—The End

Decorative Plastics Laminates in the Home
(Cont'd. from page 32)

development in light of our expansion potential. Early this year, my company introduced its new Wall Tile for bathrooms. Indications from both homemakers and builders thus far are that this will be a welcome new concept in new housing construction.

Consider for a moment: Estimated housing starts in 1959 are 1,250,000 units. There will be an estimated 1.75 baths per unit—and an average of 184 square feet of wall space in each. The bathroom-wall market thus presents a tremendous potential and if the laminated plastics industry gets only 10% of that potential, they could increase by almost 25% the total annual production of the entire industry in 1958 (which went for *all* applications).

What lies ahead? Many new products and applications! Laminated plastics for floors, for exterior surfaces, and in sandwich-panel modules for faster, more efficient construction.

Our future success will depend on our continued and increased support of research and development activities throughout our entire industry . . . activities which thus far have extended the values of our material, and its uses, far beyond what was conceived possible back in the "good old days." If we step up the pace and heighten the emphasis on product and application research and development, the horizons of our industry will be unlimited. We will not stall and permit change to leave us standing!

—The End

E. L. STRAUSS, *Design Specialist-Nonmetals, Structures Research Staff, The Martin Co., Baltimore, Md.*

Effects of Stress Concentrations on Laminate Strength

Results of a comprehensive study on glass fiber-reinforced polyester laminates are given.

A study of failures in glass fabric-reinforced plastic laminates containing stress concentrations was conducted by Martin with specific attention to single holes, multiple holes, cutouts, notches, and fillets. Holes were either drilled, or drilled and countersunk with diameters varying from $\frac{1}{16}$ in. to 1 in., and notch radii from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. Round, square, and elliptical cutouts were evaluated. Fillet radii ranged from $\frac{1}{8}$ in. to 10 in. Appropriate test specimens were loaded statically in tension, compression, and flexure. Failure invariably occurred through the location of the stress concentration, and at stress levels appreciably lower than the normal strength of the material.

One of the important factors to be considered in designing a reinforced-plastic structure is the notch sensitivity of the material. Fatigue cracks in metals tend to originate at points of stress concentrations, such as flaws in the material, surface blemishes, and corner fillets or holes. In reinforced plastics, stress concentrations induce premature failures not only after numerous load cycles, but also during application of a steady load.

The notch sensitivity of a reinforced plastic laminate can be related directly to the stress-strain behavior of the material. Figure 1 contrasts the tensile stress-strain curves of a 181 glass fabric-polyester laminate and a high-strength aluminum alloy. The plastics curve, except for the initial portion, is essentially linear up to the point of failure which occurs when the material has been strained approximately 1½%. The aluminum alloy, on the other hand, deforms linearly for approximately ¾% strain, then the metal yields and undergoes an additional 5% strain by plastic deformation before failure occurs.

Since stress concentrations cannot be avoided entirely in a practical structural plastic design, the working stresses must be sufficiently low to preclude failures in the vicinity of stress concentrations. However, little information is available to guide a designer in the selection of safe stress levels. The Martin Company, therefore, initiated an experimental program to determine stress concentration effects in reinforced plastic laminates. The material selected for this study was a ⅛-inch thick plastic laminate containing 12 layers of 181 glass fabric and a polyester resin. The program was designed to facilitate comparison of the tensile, compression, and flexural strengths of specimens con-

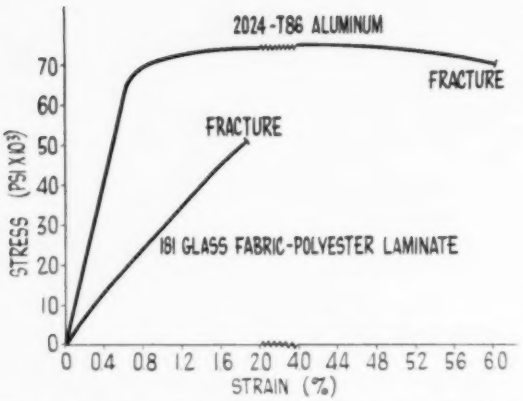

2024-T86 ALUMINUM
FRACTURE
FRACTURE
181 GLASS FABRIC-POLYESTER LAMINATE
STRESS (PSI X 10³)
0 10 20 30 40 50 60 70
0 04 08 12 16 20 40 44 48 52 56 60
STRAIN (%)

Fig. 1. Comparison of stress-strain curves for a glass fabric-polyester plastic laminate and aluminum.

Table 1. Stress Concentration Test Program.

Type of Stress Concentration	Type of Loading	Test Program Parameters
Drilled Holes	Tension, Compression, Flexure	Hole size Specimen width Ratio of hole diameter to specimen width Hole location Single row of holes
Countersunk Holes	Tension, Compression, Flexure	Hole size Comparison of drilled, counter-sunk, and countersunk-and-drilled holes
Multiple Rows of Holes	Tension	Spacing between rows of holes
Cut-Outs	Tension	Cut-out shape
Notches	Tension, Compression	Notch radius
Fillets	Tension	Fillet radius

taining various stress concentrations with the strengths of control specimens of standard shapes. Failing stresses were calculated, based on the net cross-sectional area of the specimens. Results presented in this paper represent the averages of three specimens. By adhering to normal shop practices in the fabrication of the test pieces, the resulting test values became meaningful as practical design data.

Specific types of stress concentrations investigated included drilled holes, countersunk holes, cutouts, semicircular notches, and fillets. The scope of the test program, stress-concentration types, and factors influencing stress concentration effects are given in Table 1.

Test Results

Drilled Holes

Hole Size. The isolated holes ranged from 1/16-1 inch in diameter. Tensile test data presented in Table 2 exhibit a pronounced decrease in specimen strength with increasing hole size. The normal tensile strength of the laminate was 40,700 psi., but strengths of specimens containing a 1/16-inch diameter hole ranged from 36,000-38,700 psi. A one-inch diameter hole reduced the tensile strength to a value as low as 21,700 psi. Figure 2 illustrates that the strength drop-off with increasing hole diameter holds for flexure and compression, as well as for tension. However, the flexural strength diminishes more gradually than either the tensile or compression strengths.

Specimen Width. A series of specimens was prepared in which both specimen width and hole diameter varied such that the net width (specimen width minus hole diameter) remained constant. Results of tension and flexural tests of this specimen group are compared with the normal strengths in Figure 3. Normal values are represented as 100%. The decrease in strength with increasing hole diameter again is noted. A 1/2-inch diameter hole caused a 21% loss in the flexural strength and a 26.5% loss in the tensile strength of the laminate.

Hole Diameter: Specimen Width Ratio. The ratio of hole diameter to specimen width (d/w ratio) was an additional parameter in the stress concentration investigation. Hole diameters ranged from 5-58% of specimen width. The tabulated tensile test results in Table 2 show a general increase in failing stress with increasing d/w ratio. Flexural and compression test results, summarized in Table 3, display the same general trends as the tensile test results.

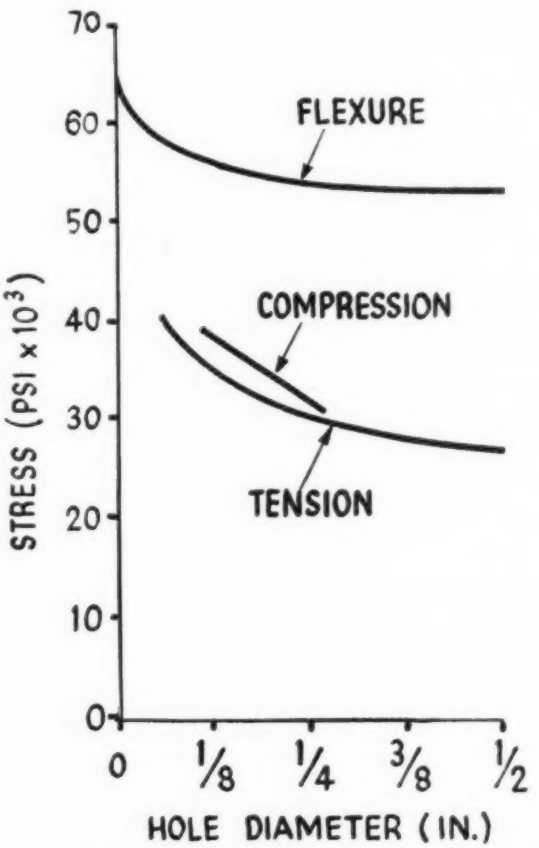


Fig. 2. Variation of specimen strengths with hole diameter (hole diameter: specimen ratio = 0.143).

Table 2. Tensile Strengths, Psi., of Glass Fabric-Polyester Laminates* Containing Holes of Various Diameters.

Hole Diameter, In.	Specimen Width, Inches					
	0.05	0.083	0.143	0.250	0.400	0.571
1/16	36,000	38,700	38,500	—	—	—
1/8	33,500	35,700	37,700	35,400	—	—
1/4	—	29,000	30,600	30,100	35,900	—
1/2	—	—	27,100	30,000	30,000	—
1	—	—	—	21,700	—	30,800

* Nominal tensile strength, 40,700 psi.

Table 3. Flexural and Compressive Strengtos, Psi., of Glass Fabric-Polyester Laminates* Containing Holes of Various Diameters.

Hole Diameter, In.	Specimen Width, Inches					
	0.050	0.078	0.083	0.143	0.250	0.400
1/16	57,700F	58,100F	—	—	—	—
1/8	56,700F	—	57,500F	56,000F	—	—
1/4	53,700F	—	57,200F	54,600F	56,600F	—
1/2	—	—	47,500F	53,700F	—	51,700F
1/16	24,600C	45,400C	—	—	—	—
1/8	—	—	15,500C	39,100C	—	—
1/4	—	—	—	32,200C	28,600C	—
1/2	—	—	—	—	—	26,400C

* F=Flexural strength, nominally 65,200 psi.
C=Compressive strength, nominally 30,300 psi.

HOLE LOCATION. Effects of hole location were investigated with another group of test specimens. The position of a ¼-inch diameter hole in a three-inch wide specimen was varied from a location at the specimen center to a location $\frac{3}{16}$-inch from the specimen edge. Data obtained indicated no significant strength difference between on-center and off-center locations of holes.

HOLES IN A SINGLE ROW. Specimens with multiple holes in a line were tested to ascertain whether a row of holes behaves in a similar manner as isolated holes. In these tests, the single-hole specimen failed at a higher stress-level than the comparative multiple-hole specimen. It would follow that the larger number of holes in the multiple-hole specimens increases the probability of early crack formation and propagation, thus lowering the stress level at which failure occurs.

Countersunk Holes

HOLE SIZE. The hypotheses established for drilled holes apply equally to countersunk holes. Specifically, strength decreases with increasing hole diameter size, and specimens containing a single hole are stronger than comparative multiple-hole specimens.

COMPARISON OF DRILLED, COUNTERSUNK, AND RIVETED HOLES. Strengths of specimens containing drilled holes, countersunk holes, and countersunk and riveted holes are compared in Figure 4. Countersunk holes were machined to standard tolerances for 100° flush-head rivets. Countersunk and riveted specimens were prepared in the following manner:

(1). 2024 aluminum alloy rivets were dipped in a room temperature-curing epoxy adhesive and inserted into the drilled and countersunk holes.

(2). An aluminum washer was placed over the rivet shank and the driven head was formed. The adhesive was intended to repair local delaminations or other defects which may occur during machining and to assure that the rivet completely fills the hole. A mean hole diameter was utilized in calculating failing stresses of specimens containing countersunk holes.

Countersinking reduced the failing stress approximately 5% in both tension and compression when compared with drilled holes. Flexural test results were inconclusive. Insertion of a rivet resulted in a significant increase in specimen strength for all three loading conditions. The greater strength was expected in com-

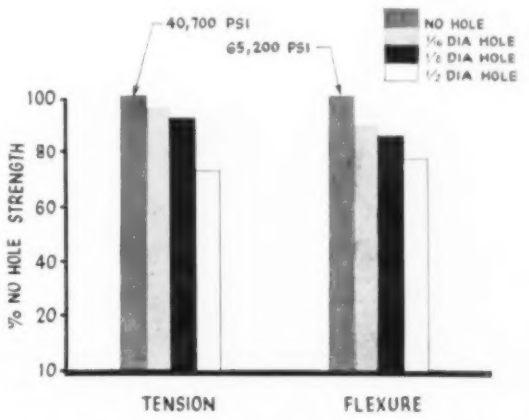


Fig. 3. Tensile and flexural strengths of glass-polyester laminate as functions of hole diameter (constant net width of specimen = 0.750-inch).

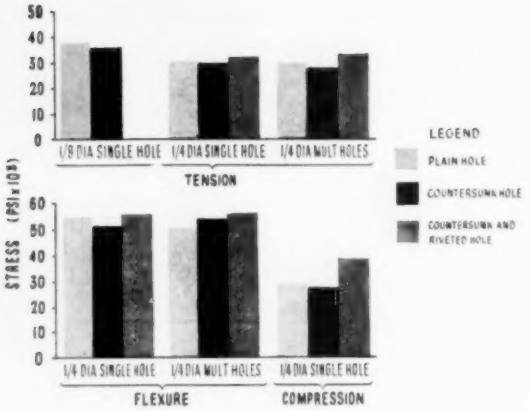


Fig. 4. Effect of hole configuration on specimen strength (hole diameter:hole width = 0.25-inch).

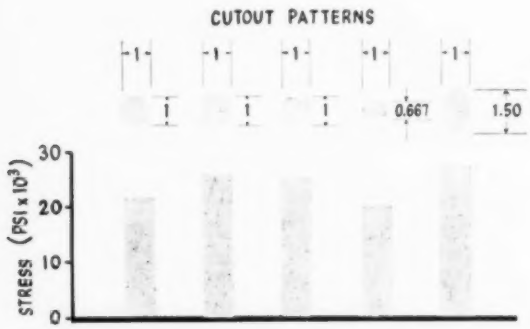


Fig. 5. Effect of hole cut-out pattern on tensile strength of glass-polyester laminates (constant net width = three inches).

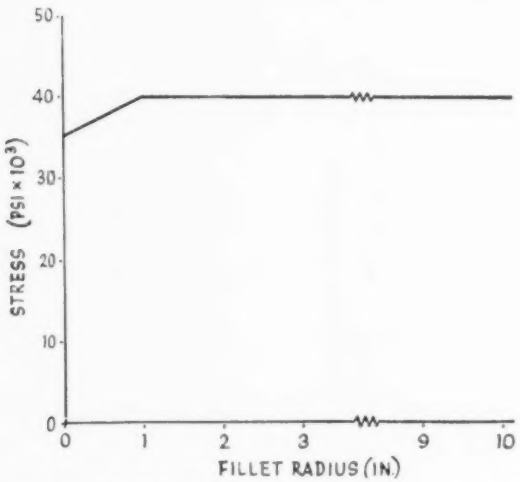


Fig. 6. Effect of fillet radius on tensile strength of glass-polyester laminates.

pression and flexure, since the rivet is capable of transmitting a compressive load across the hole. In tension, the adhesive apparently bonded the rivet to the sides of the hole so that a tensile force also could be transmitted by the rivet across the hole.

Multiple Rows of Holes

SPACING BETWEEN ROWS (BACK PITCH). A series of specimens containing multiple rows of holes was tested in tension to determine the effects of varying spacing between rows (back pitch). Specimens were four inches wide, containing three rows of staggered holes with one-inch spacing between holes. Tensile test results with ¼-inch diameter holes are summarized and compared to a specimen of similar configuration containing a single row of holes, as follows:

Spacing Between Holes, In.	Failing Stress, Psi.
1	24,200
½	26,900
¼	25,400
Single row of holes	29,300

These test data reveal no appreciable difference in the strength of multiple-row specimens containing spacing of one-, ½-, and ¼-inch between rows. However, the single-row specimen was considerably stronger than any of the triple-row specimens. This confirms the previous conclusion that for four specimens containing equal hole size and hole spacing, the one having the largest number of holes will fail at the lowest stress level.

Cut-Outs

CUT-OUT SHAPE. To faciliate a direct comparison of the influence of cut-out shape, all specimens were four inches wide and contained cut-outs of one-inch width. Circular, rectangular, and elliptical cutouts were investigated. Tensile test results are illustrated in Figure 5.

The elliptical cut-out whose major axis ran perpendicular to the loading direction caused the greatest reduction in tensile strength, while the ellipse whose major axis ran parallel to the loading direction exhibited the highest tensile strength. The strengths of specimens containing rectangular cutouts with either square or rounded corners were approximately equal, and were appreciably higher than the strength of the specimen with the circular cut-out.

Notches

NOTCH RADIUS. Specimens with semi-circular notches were similar in many ways to specimens containing holes of equal radii. Test results are summarized in Table 4. In the series of specimens of constant ¾-inch net width, strength decreased with increasing notch radius. When notch radius was held constant, strength increased with increasing d/w ratio where d = 2 x notch radius.

Fillets

FILLET RADIUS. A standard tensile specimen for

plastic laminates has a ½-inch wide gage section that is 2¼-inch long and flares out at both ends to a ¾-inch width. The transition is formed by arcs of three-inch radius. Effects of variations in fillet radius were investigated by retaining the essential shape of the standard tensile specimen, but varying the transition radius from 10 inches to ⅛-inch.

Test results are illustrated graphically in Figure 6. This curve shows that strength remains unaffected by fillet radii ranging from 10-1 inches, but decreases when fillet radii become smaller than one inch. The standard tensile specimen containing the three-inch fillet radius yielded strength values of 40,700 psi. A specimen containing a ¼-inch diameter fillet radius failed at 36,000 psi., representing a 10% loss in strength.

Test Conclusions

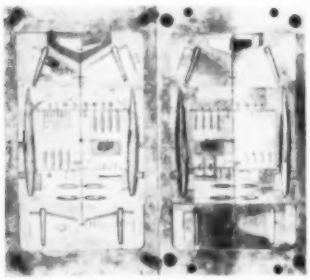
Stress concentrations in reinforced plastic laminates can produce failures at exceedingly low stress levels. For example, a four-inch wide specimen containing a one-inch diameter hole failed in tension at 21,700 psi., whereas the normal tensile strength of the material was 40,700 psi. The loss in strength was most pronounced for tensile loading and was less critical in flexure.

The strengths of specimens containing holes decreased with increasing hole diameter. In a group of specimens containing the same diameter hole, strengths increased with increasing hole diameter:specimen width ratio. Specimens containing multiple-holes failed at lower stress levels than an equivalent specimen containing a single hole.

Countersunk holes were approximately 5% weaker than corresponding drilled holes. Semicircular notches and holes of equal radii produced similar stress concentration effects.

Strength reductions obtained by varying the fillet size from the standard three-inch radius used in tensile specimens to a ¼-inch radius were approximately 10%.

—The End



After set-up, only occasional spot checking is required for tracing.

Pre-Met Meets Mold Problem

Die mold prior to firing. Male hobs are machined, then pressure cast or pushed into hobbing steel.

A West Coast mold maker, Pre-Met Corp. of El Monte, Calif., recently saved 135 man hours of machining and reduced hand finishing time by over 50% with the installation of an automatic 3D hydraulic tracing system on one of its standard milling machines. The unit, called a Synchro-Trace, is a product of True-Trace Sales Corp., also of El Monte. Two other "extras" found by Pre-Met were a 50% increase in tool life and the elimination of preliminary resin base-filler casting.

The Synchro-Trace scans the entire part surface, including 90° angles, from set-up to automatic shut-off. The standard mill becomes a profiler suitable for die sinking, mold making, and general contour work. Tolerances within two mils are held consistently, it is reported.

Operation is simple. A template is mounted on the table, and hand screw feed selection is available for all slides. A fluid motor, with clutch, is used on longitudinal and cross feeds, and a hollow rod cylinder with screw is used for verticals. The stylus is induced automatically to follow the template contour, thus duplicating the movement of the cutter.

Wherever possible a flat stylus is used to scan the part and a standard two-flute HSS cutter is used in the mill. Two passes are sufficient; one for roughing, the other for finishing. Die hobs can be produced directly from soft wooden models, thus eliminating casting—as mentioned earlier.

Finish details are reproduced freehand by an engraver. Before hobs are pressure cast in beryllium or hobbed in steel, they are heat treated to 58-60 on the Rockwell C scale. Cavities are then retained, squared, and accurately matched. Protruding rivets are placed in the form after the cavity is produced. Feed rate is uniform regardless of contour.

—The End

DAVID BINCH, Foreman
Precision Molding Section
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Taunton, Mass.

Precision Molding

How a company set up its equipment and quality-control facilities for precision molding of thermoset parts during production runs.

TWO trends evident in industry today are the demand for higher-precision components and the complementary demand for miniaturization of components. This is true particularly in the electronic and aircraft instrumentation fields, and has resulted in demands on the custom-plastics molder for parts with exceptional dimensional stability, greatly improved electrical properties and, often times, with complex molded-in inserts.

While much credit must be given to material suppliers and machinery manufacturers for developing improved compounds and equipment to meet these demands, it has become increasingly apparent to those involved in molding such parts that a new approach was necessary to produce precision moldings successfully. In early 1956, G-E's Plastics Department started plans for creating a "Precision Molding" unit within its Taunton, Mass., custom thermosetting molding plant. The general plan called for the creation of a self-contained area of specialized equipment and personnel, with the accent on quality control. With the plant's sale to Haveg, the new owner has continued the plan.

It might be well at this point to define what is meant by precision molding in our Department. "Precision molding" is a term used to describe a technique for producing parts of the following general characteristics: those having more than 12 dimensions that meet the *standard* tolerance classification, and those with four or more dimensions that meet the *fine* tolerance classification, as described in the Handbook of the Society of the Plastics Industry. Figure 1 shows these classifications for an electrical-grade urea-formaldehyde material.

While it is obvious that this definition cannot be applied completely and rigidly, it does provide a rule-of-thumb to measure potential parts for our Precision Molding Area and, conversely, to insure that parts of a lesser precision do not "down-grade" the area. It should be emphasized that the parts we wished to produce in this area were not merely difficult or "trouble" jobs, but only those which qualified by virtue of the dimensional precision required.

Sales promotion for precision molding work started long before the area itself had been completed. Our salesmen were instructed not merely to sell the fact that we were able to take on the most precise molding jobs, but to make specific effort to solicit this type of work. The response to this appeal was gratifying, and within several weeks we had quoted on a number of molds that qualified for our Precision Molding Area. Simultaneously, an analysis was made to determine which jobs presently active in our press-room qualified for transfer to this area. In this manner, a nucleus of jobs for our Precision Molding Area was established and it became feasible then to set-up the physical facility, itself.

Equipment Design

A great amount of effort went into designing the basic pressing equipment and its hydraulic system. Working on the premise that precise parts cannot be molded consistently with standard equipment and controls, our Facilities Engineering Unit specified that any press being assigned to this area must first be dismantled completely and then rebuilt "from the ground up." This

included planing all platen surfaces, reboring and rebushing for the press posts, removing main rams (respraying, if necessary), mounting new transfer cylinders where needed, modifying all knock-out systems for hydraulic operation and, finally, cleaning and painting all presses.

Hydraulic System

The hydraulic circuit (see Figure 2) was redesigned to incorporate the latest pump, valve, and control features; including sub-plate-mounted solenoid valves, hydraulic boosters, and pressure reducers. To eliminate surges and pressure fluctuations, a separate low-pressure pumping unit with a pulsation dampener on the discharge line was installed for this area. The electric circuit includes 440-volt and 220-volt preheater outlets, 110-volt utility outlets, and lights and mold-temperature control units at each press. Limit switches have been included in the solenoid circuits to prevent any accidental or out-of-sequence motions that could damage costly molds or endanger operating personnel. The facilities also incorporate underground location of utility feeders and standardized press units (see Figure 3) to reduce maintenance and rearrangement costs.

Mold Design

Since a molded part is only as good as the tool from which it is produced, no detail is spared in the area of mold design and construction. One mold currently in production produces a part small enough to hold in the palm of your hand, yet having approximately 130 decimal dimensions. During the sampling period for this mold, any one of 20 dimensions would have been a cause for rejection by being as little as 0.0001-inch out of tolerance. Furthermore, due to the complexity of the part involved, most molds have cylinder- or mechanically-actuated wedges to mold under-cuts, and removable wedges to speed insert loading. To facilitate replacement due to wear, areas in the molds subject to excessive plastic flow are designed to be readily removable, often without removing the mold from the press.

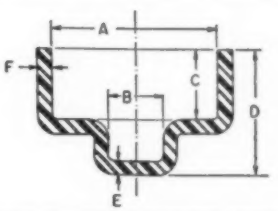
As an adjunct to high-quality molds, auxiliary equipment for performing such operations as gate grinding, flash removal, cooling, and wedge disassembly is purchased externally or designed and built in our own tool room. As often as possible, this equipment is designed to be fully- or semi-automatic in operation in order to eliminate the possibility of human error, yet flexible enough to accommodate many sizes and shapes of molded parts.

Quality Control

Quality control, being of prime importance in such an operation, was established on a sound statistical basis and is policed rigidly. In some instances, the ratio of inspection labor to direct labor for these parts is as high as 15%. This has resulted, however, in an extremely low scrap rate (see Table 1) and a record of no complaints or returned material. Sampling procedures for process control and final inspection are

MATERIAL: *ELECTRICAL GRADE UREA-FORMALDEHYDE MATERIALS*

Drawing Code	Dimensions (In.)	Plus or Minus in Thousands of An In.*		
		Fine ±	Standard ±	Coarse ±
A = Diameter or Length B = Diameter or Length C = Depth	6.000 to 12.000	0.005	0.007	0.009
	For each inch over 6.000 add (in.)			
	Over 12.000	0.004	0.006	0.009
	For each inch over 12.000 add (in.)			
HEIGHT D	Single Cavity 0.000-1.000	0.002	0.005	0.008
	Multiple Cavity 0.000-1.000	0.004	0.006	0.010
	For each inch over 1.000 add (in.)	0.003	0.004	0.004
BOTTOM WALL E	0.000 to 0.100	0.003	0.004	0.008
	0.100 to 0.200	0.003	0.004	0.008
	0.200 to 0.300	0.003	0.004	0.008
SIDEWALL F DIMENSION**		Section thickness to be held relatively constant		
F Variation in wall thickness due to eccentricity, 0.005-0.007 in. Interlocking reduces this.				
DRAFT ALLOWANCE		1/8°	1/4°	1°



* These tolerances do not apply to screw threads, gear teeth, or fit of mating parts; dimensions in these classifications can generally be held to closer limits. These tolerances do not include allowance for aging characteristics of material.

** See introduction to chapter.

DWG. CODE			
D, E	Compression Molded For projected area over 20 sq. in.	Fine	Add 0.001 in. for each additional 10 sq. in.
		Standard	Add 0.002 in. for each additional 10 sq. in.
		Coarse	Add 0.003 in. for each additional 10 sq. in.
	Transfer, Jet, or Injection molded Any area	PLUS OR MINUS TOLERANCE IN THOUSANDTHS OF AN IN. (F = Fine; S = Standard; C = Coarse)	
		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	
D	Single cavity	F S C	
D	Multiple cavity	F S C	
D	For each inch of depth over 1.000 add (in.)	0.002	

(Courtesy of the Society of the Plastics Industry, Inc.)

Fig. 1. Standards of tolerance for a commonly-used, electrical-grade, urea-formaldehyde molding material.

Table 1. Scrap Control Data Taken From Representative Production Runs.

Molded Parts	Total Molded	Percent Scrap
"A"	60,022	3.5
"B"	84,870	1.2
"C"	44,162	1.8

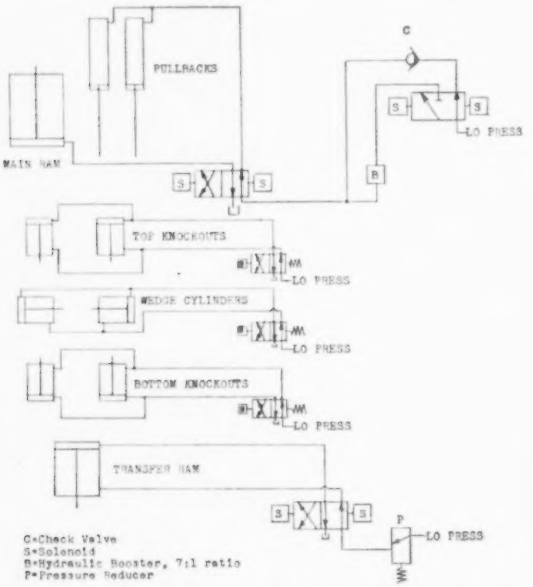


Fig. 2. Redesigned hydraulic system for precision molding. Note that only one pump pressure (LO) is required. Booster provides clamp pressure, and reducer provides proper transfer pressure.

based on MIL-STD-105A, and each dimension or other attribute is analyzed to determine the Acceptable Quality Level to which it should be inspected. Standard forms and inspection data sheets are provided for each molded part to assure continuity of inspection throughout all three operating shifts.

As a final step to provide organizational control for the Precision Molding Unit, all manufacturing activities (molding, finishing, inspection and packaging) are contiguous and supervised by one foreman. This guarantees prompt feed-back of information, whether it be from an inspector or an employe on the finishing line. In this manner, production of off-spec or even marginal-quality parts is detected promptly and corrected (see Figure 4). Constant emphasis of the "precision" aspect of this unit and careful selection of personnel for the area has resulted in an extremely high quality-conscious attitude. Coupled with the procedures and physical equipment discussed above, this attitude has given our Department a section uniquely adapted to handle the most complex precision molding work. —THE END

Fig. 4. Control chart for 0.400±0.003-inch dimension during molding over a three-month production period. Each point represents the average of six readings taken from different wedges. (Right)

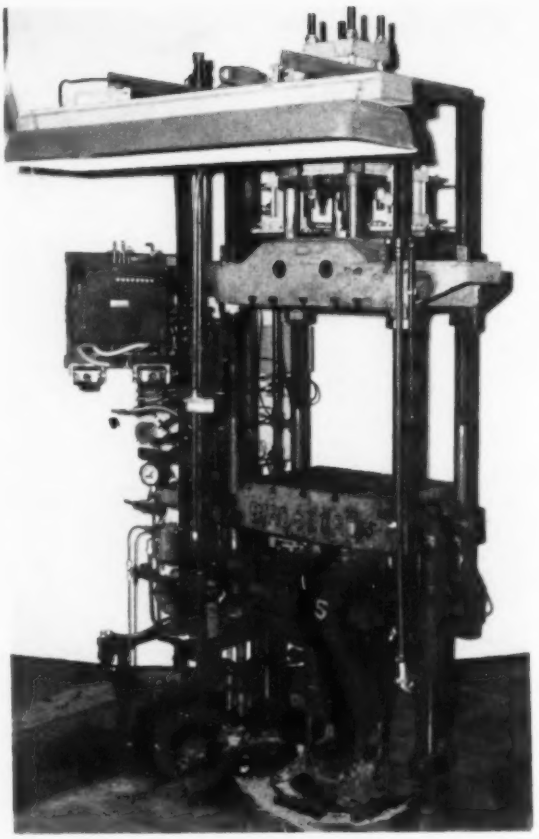
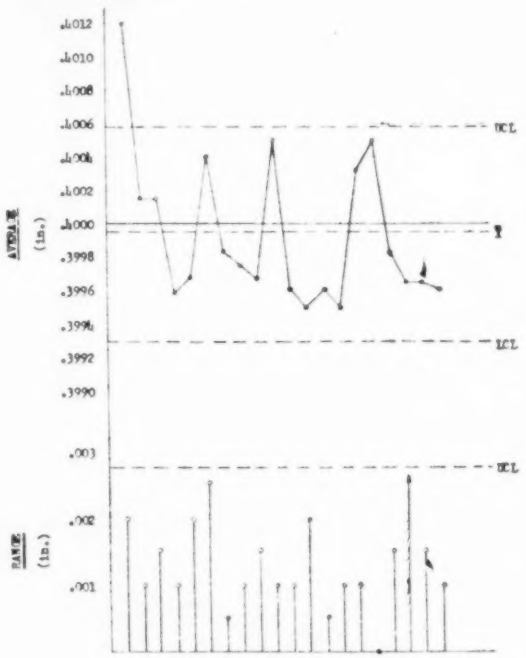


Fig. 3. Press unit prior to final cleaning and painting. Note underground feeders with shut-off valves permitting easy removal of press, complete with controls, for maintenance overhaul or unit substitution.



Edited by:
GEORGE E. VENTZ, *Pres.*
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Machinery Maintenance

Corrosion and its Prevention

IN my opinion, there is no other subject more disregarded and neglected than the prevention of corrosion in cooling lines, water jackets, and manifolds in molds and molding machines.

Automobile radiators are drained and flushed every spring and fall, and rust-resisting chemicals are added to assure free water circulation and a cool engine. Yet, a mold, that sometimes equals the price of three automobiles and has many small cooling lines around the cavities and cores, never receives this service.

Mold cycles are carefully checked in production operations, yet quite frequently at a later date in this same operation a longer cycle is required to mold this same item. This is due to insufficient cooling followed by poor shrinkage control.

Naturally, this situation will not occur in newer molds. I have observed in a contract molding plant, where older molds have been stored on shelves for a long time, that the cooling lines were rust blocked by up to 75% of the capacity. And, may I add, this is no rare occasion.

What will happen if this mold is put into production without cleaning out the corroded water lines? A waste of time and money, inferior products, and often barrels of scrap.

How many operators actually check the return flow of cooling water to make sure of proper circulation, and how many molders order their personnel to blow out water residue before the mold is stored away until the next production run? A radiator rust preventative poured into the cooling lines of any mold before storage will eliminate trouble, and save time and money.

Waste-water manifolds, installed on many molding machines, often are another cause of poor circulation. This happens when the small return-flow connections are corroded, and block the free flow of the cooling water. These manifolds also require periodic inspection and cleaning to secure a good cooling system.

—THE END

Errata

We wish to correct the erroneous listing given in our May issue, pages 53-54, whereby Injection Molders Supply Co., 3514 Lee Road, Cleveland 20, Ohio, was omitted from the Classified List of Auxiliary Equipment for injection molding in the categories for Heating Cylinders and Hopper Loaders. Now if only we could be as efficient as our gremlins! Our apologies to IMS and to our readers for the omission.

The correct listings are as follows:

Heating Cylinders

Clifton Hydraulic Press Co.
Hannifin Co., Div. of Parker-Hannifin Corp.
Injection Molders Supply Co.
Trubor Mfg. Co., Inc.

Hopper Loaders

Injection Molders Supply Co.
The Rainville Co., Inc.
Thoreson-McCosh, Inc.
Universal Dynamics Corp.
C. H. Whitlock Associates

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Aerosol Containers . . .

. . . products of a multi-million dollar a year industry, are now convenient, familiar household and industrial items. Recent research statistics indicate that the consumer has eagerly accepted this mode of packaging for foodstuffs as well as other utilitarian products.

Presently, plastics play a major role in the manufacture of component parts such as valve stems, valve bodies, dip tubes, and gaskets. With further advances in plastics technology, thermoplastic materials may be used for all components, with the exception of a metal valve clamp. Plastic materials please the esthetic senses by their form, texture, and color. Also, the new plastic containers have none of the drawbacks of their predecessors, such as the typical cylindrical shape of metal or the frangibility of glass containers. Because of this, they will vie for a large portion of the over-all market.

A container formed of a marriage—glass and a vinyl plastisol—has found acceptance in the cosmetics field. Wheaton Plastics Co. of Millville, N. J., was among the first to manufacture and distribute such a successful unit. Its great advantage is that almost all materials can be packaged satisfactorily in a glass vessel. The fact that glass is breakable and that a glass-lined plastic container is a practical impossibility, led to the development of the plastic-coated glass bottle.

Plastic bottles run the gamut of all known thermoplastic resins. Each has been tried and some are presently being tested in market surveys. Those in commercial production include nylon, Delrin, high-density polyethylene, and Lexan. The bottles are manufactured by two competing processes—injection molding, and blow molding. In injection molding, two halves of the bottle are molded with mating lips at the cross-sectional

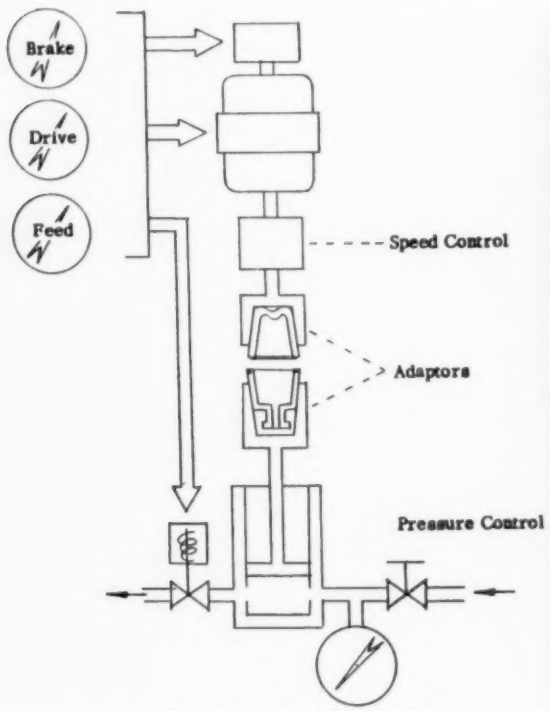

Diagram Courtesy: E. I. DuPont De Nemours & Co., Inc.
Spin Welding Equipment.

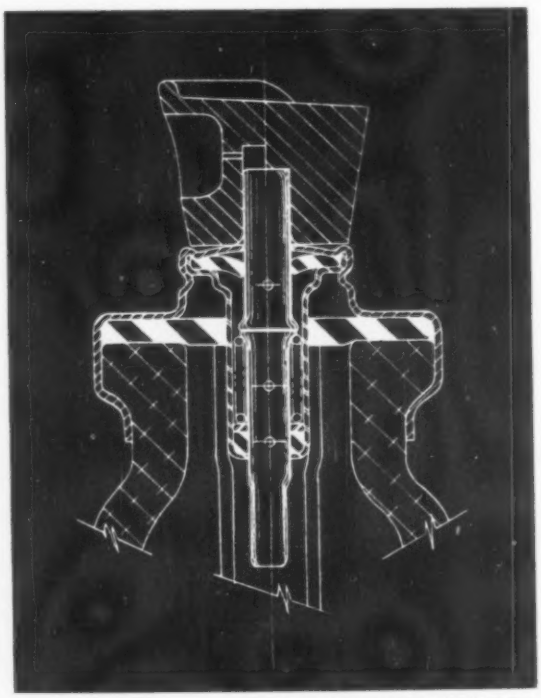

Diagram Courtesy: Precision Valve Corp.
Valve section—typical neck design.

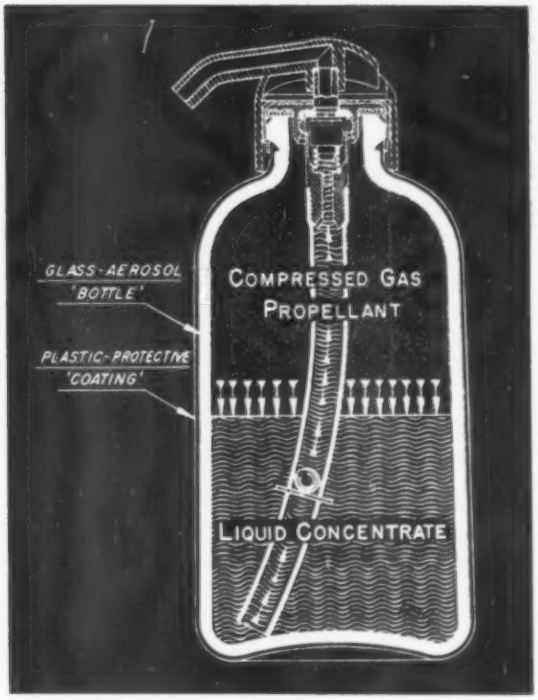

Diagram Courtesy: Precision Valve Corp.

Plastic coated glass aerosol container with metering valve.

division. After removal from the mold, the two halves are welded or clamped together by metal bands.

The welding process, developed by E. I. Du Pont de Nemours & Co., Inc., is called "Spin-Welding." Basically, the process employs a rotating mechanism in which one-half of the molded form spins and rubs on the stationary member. Frictional heat causes the material to melt, thus mating the two halves and fixing them together under pressure. The other method, blow molding, has been moderately successful in forming thick-walled containers, but its inherent drawback is the tendency of material to thin in the corners. This tendency toward uneven wall thickness, especially in a pressurized container, can become a point of failure. Specialized blow-molding machinery is being used to preform the neck section and, by proper design of the container, limits or eliminates thinning of the wall section.

One advantage that blow-molding offers is the manufacture of bottles with large and graceful undercuts. Design of the container will in most cases dictate which of the two processes is best. Conversely, the method used in production will also dictate the container design.

It is important to note that containers made of plastic material cannot be used indiscriminately to package all substances. This is due to different permeability characteristics as well as corrosion and solubility resistances of each of the plastic materials. Permeation of a non-reactive substance through the wall of a plastic container can be considered to occur in three distinct steps: (1) solution of the substance in the plastic; (2) diffusion through the plastic; and (3) evaporation of the substance from the outer surface. The rate of permeation depends on wall thickness, temperature and, in some cases, the pressure of the substance, as well as the rates of solution, diffusion, and evaporation.

To combat permeation in a plastic container, some manufacturers resort to lining it with an impervious coating. In many cases, the container is lined with a fluorocarbon resin or the lining is fluorinated by exposure to fluorine.

•

Blow Molding . . .

. . . by the injection method has evolved in normal fashion from standard injection molding machinery. Over the years, injection molders with an inventive turn of mind modified their surplus injection molding equipment. These machines range from semi-automatic to fully automatic types in operation. Some experimenters found they could use the head-section intact, adding a new nozzle to form the parison. The mold-clamp section also had to be built anew, since it is a radical departure from the type used in injection molding. Although the rebuilt machines usually looked very much "made over", they performed capably and served their purpose well in many captive operations. Some are still in use, while others have been scrapped in favor of the blow molding machines currently offered.

A new approach has been taken by the Battenfeld Corp., an original equipment manufacturer. This company has redesigned a standard line of its vertical injection machines specifically to perform blow-molding operations.

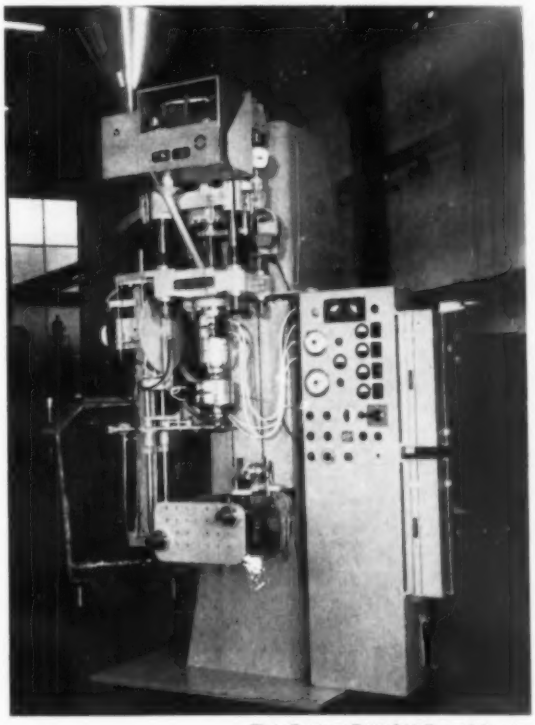

Photo Courtesy: Battenfeld Corp. of America

Blow-molding machine.

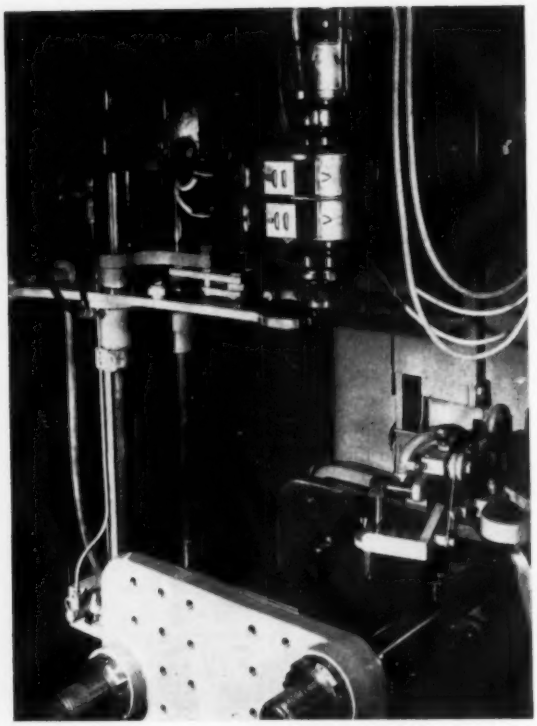

Photo Courtesy: Battenfeld Corp. of America

Close-up of transport mechanism and blowing tube.

A brief description of this machine's operation is as follows: The injection cylinder extrudes a parison downward. When a predetermined length is formed, a scissors-clamp transports the parison from the nozzle to the mold. After the mold closes on the parison, the air tube is cammed into place. During the blowing and cooling portion of the cycle, the next parison is formed at the nozzle. When the finished blown-ware is ejected, the cycle automatically repeats itself.

One advantage of this type of unit is its ability to use some of the more difficult resins which do not lend themselves well to extrusion. Another feature is a weigh mechanism that loads a predetermined charge into the cylinder.

It is possible to vary the timing (within limits) to accomplish a longer preplasticizing dwell-time in the cylinder. Also, a lengthened dwell period of the scissors holding the parison, particularly when the material is polyethylene, will tend to oxidize the surface so that the finished product will not need secondary processing before printing.

•

Plastic Compounds . . .

. . . play a vital role in embedding and encapsulating electrical and electronic components. The demands of modern electronic packaging have necessitated the development of resins which will withstand, among other stresses, higher frequency operation, extremes of temperature, and higher acceleration loads.

By 1960, missiles and rockets will have become as familiar as the automobile. Guided missiles and satellites hurtling through space create shock stresses in the components of their delicate instruments. Consequently, greater strength, shock absorption, and better dielectrics are required from the latest group of resins offered by the plastics industry.

Plastic materials presently being used to fabricate potted assemblies include acrylics, polyesters, and epoxies. Materials such as silicones and fluorocarbons, while still relatively expensive, are being resorted to more frequently for encapsulation. The advantages of these resins in many instances outweigh their cost, particularly when specifications are rigorous with respect to high temperature dielectrics and other extreme factors.

In the silicone grouping, Dow Corning Corp. has produced a cureable jelly-like material for potting techniques. Like other specific potting compounds, this material seeks out and fills every void—then cures to form a transparent gel. Silicone gel provides a resilient embedment which protects unit assemblies from vibration, shock, moisture, dirt, and dust. The combination of properties that make this material unique are: it allows visual examination of potted circuitry; it remains fixed in place when units are turned upside-down or tilted (even when subjected to temperatures in excess of 300° F.); the gel can be probed with instruments to check circuits or replace parts (when the probing tool is removed, the gel immediately reseals itself); it exerts no stress on delicate parts either during or after cure; the material, once gelled, is dimensionally stable and does not revert to a fluid. The gel also exhibits good thermal stability with no noticeable change in properties from —70° to 390° F. Like other silicones, this compound is inherently resistant to water.

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After curing, the easily applied silicone liquid assumes a resilient, jelly-like form that is "self-healing"—seals itself after physical disturbances. (See cover photo.)

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At the present writing, data on gas permeation does not exist.

One inherent drawback of silicones is their instability in the presence of chlorinated and aromatic hydrocarbons, although their chemical resistance is generally good.

The Dow Corning gel composition exhibits a slow combustion rate and is self-extinguishing when the flame source is removed. This gel, like other silicone compounds, also has good ozone resistance.

Strain-sensitive electronic equipment, such as accelerometers and magnetic amplifiers, which is adversely affected by the compression stresses caused by shrinkage in solid resins, can be potted in the gel with excellent results. Furthermore, using the silicone gel will probably prevent scrapping an entire assembly in case of an error. Thus, expensive solvents are unnecessary to salvage costly parts. The components can be removed from the cured gel, readily cleaned, reworked, and repotted in new gel without loss or damage.

With continuous research being conducted in silicones and the new dielectric gel, the electronics industry can look forward to better plastic materials with substantially improved physical properties. —THE END

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NEWS

market forecasting

Cellophane sales climbed to a new high last year despite recession and competition. Total sales were reported at 403 million pounds, though usage soared still higher to 415. Most significant development during the year was the expanding market for polymer-coated films. Domestic manufacturers of cellophane are **E. I. du Pont de Nemours & Co., American Viscose Corp.,** and **Olin-Mathieson Chemical Corp.**

Chemical Marketing & Research Co.'s James Margolis spoke before the ACS recently on the "Outlook for Synthetic Adhesives." He estimated that their use would grow by 15% over last year's levels. Phenolics were expected to lead, mainly due to their use in honeycomb sandwich panels. Epoxies, not a volume factor up to now, were cited as attractive long-term prospects.

The Manufacturing Chemists' Association predicts that the nation's chemical producers will spend at least $87-million to construct new laboratories in 1959 and 1960. This includes an estimated $59.6-million for projects underway and $27.425-million for facilities in the near future.

Monsanto Chemical Co.'s plastics division estimates that 709 million pounds of plastics were used in construction during 1958. Based on industry and government statistics, the figure does not include 266 million pounds of alkyds and rosin modifications used in paints, but does represent about 21% of the plastics industry's total production. The breakdown is as follows: acrylics for lighting and paint, 12-million pounds; melamine and urea for plywood bonding and high-pressure laminates, 66 million; phenolics for bonding, hardboard, insulation, wiring, and laminates, 155 million; polyester panels and piping, 19 million; polyethylene wire coating, insulation, and pipe, 110 million; styrene wall tile, insulation, paints, and lighting, 140 million; and vinyl wire covering, flooring, wall covering, pipe, and lighting, 207 million pounds.

Monsanto Chemical Co. recorded a first recently—the first 100,000-pound bulk shipment of styrene molding material. A covered hopper car, loaded and unloaded pneumatically, carried the compound to **Amos Molded Plastics,** Edinburg, Ind., from the plant in Springfield.

National Aniline Division, Allied Chemical Corp., has predicted a steady increase in the sales of anhydrides to the electrical and electronics industries this year. The firm bases its claim on the fact that three important anhydrides are replacing diamines for the curing of epoxies, especially where heat cures are required. Being liquids, they are easier to handle and can be used in laminating compositions, potting, encapsulating, and impregnating.

Republic Aviation Corp. has received two contracts to produce plastic radomes for small, portable radar units. Orders came from **Sperry Gyroscope** and **Philco's** government & industrial division.

Plastics Sheet Forming should show a 10% increase during 1959, according to Robert P. Kittredge, chairman of that division within the Society of the Plastics Industry. This would mean that 155 million pounds of raw plastic will be consumed, as opposed to 140 for last year.

general/specific interest

Food Additives Amendment of 1958, a recently passed law, amends the Federal Food, Drug, and Cosmetic Act of 1938 " . . . to prohibit the use in food of additives which have not been adequately tested to establish their safety." This law also applies to substances that may incidentally become part of foods through packaging or similar means. In effect, the law makes pre-testing of food additives a legal requirement; whereas before, it was a voluntary responsibility of the manufacturer and/or commercial user.

of the Industry

Columbus Coated Fabrics Corp. has developed a non-staining finish for its Colovin vinyl laminate sheeting. This sheeting can be laminated to steel, aluminum, and other metals.

Ohio-Apex Division, Food Machinery & Chemical Corp., reports that its recent fire was confined to the middle section of the plasticizer building, and that there will be no significant interruption in the production and delivery of these products. Temporarily, the materials will be manufactured in spare facilities located in other portions of the plant. The fire reportedly started when chemical fumes escaped from a distillation unit into the atmosphere.

offer price savings

Foster Grant Co., Inc., is currently offering an assured price and delivery schedule for colored molding compounds to those customers who can anticipate their needs and meet minimum quantity delivery standards. Under this "color requirement plan," prices are 23¢/lb. for general purpose colors in bags (Fostarene), and 32½¢ for high-impact colors (Tuf-Flex). A full statement of customer requirements can be obtained from Foster Grant. The firm is located in Leominster, Mass.

Scott Testers, Inc., has announced a merchandising program which makes its equipment available on five-year installment purchase or rental purchase plans. Normal down-payment will be 20% for purchase; one month's advance for rental. Other either arrangement, terms will extend to five years on purchase of over $1,500, and to three years on smaller orders.

Skin-Pack, Inc., now offers a rental service for its skin- and blister-packaging equipment. $65 per month includes all units for a complete packaging job, and purchase plans are available. The new service enables any firm to try this packaging method at no financial hardship.

agents, distributors, agreements

Synthane Corp. has named **Pacific Electric Sales Co.,** Portland, Ore., as its sales representative in the Pacific Northwest.

news from abroad

british plastics industry

The British plastics industry showed a general increase in 1958 over 1957. Sales rose 6% to 415,000 tons, and home consumption, 8%, to 340,000 tons; exports stood at 122,600 and imports, at 44,000 tons. PVC remains the top-ranking plastic in Britain, although imports from Europe, America, and Japan are causing concern among manufacturers. Australia continues to be Britain's best customer.

danish synthetic resins

A/S Danske Oliemoller O G Saebefabrikker is commencing full commercial production of polyester and alkyd resins at its new facilities in Copenhagen. The resins, which include polyesters for use in reinforced plastics and alkyds for protective finishes, are being made under special license from Schenectady Varnish Co., Inc., Schenectady, N. Y.

dupont orlon concern in netherlands

Dupont is constructing a factory at Dordrecht, expected to go on stream at the end of 1961, which will produce Orlon for the European markets. With a capacity of 7,000,000 kgs. of fiber, it will supplement the modest production of Nyma, Nijmegen.

english journal founded

Butterworths Scientific Publications, Ltd., will publish the first issue of a new quarterly, "Polymer," in October, 1959. It will contain original papers on the chem-

istry, physics, and application of polymer research and related developments. Members of the Advisory Editorial Board are Dr. C. H. Bamfor, Courtaulds Ltd., Research Laboratory, Maidenhead; Professor C. E. H. Bawn, University of Liverpool; Professor Geoffrey Gee, University of Manchester; and Dr. Rowland Hill, Research Director, I. C. I. Fibres Division, Harrogate.

german polyblends and polyethylene

Farbwerke Hoechst A.G., Frankfurt, has named its polyblends of PVC and chlorinated polyethylene Hostalit Z. Ranging from rigid, high impact types to soft, flexible grades, the main advantages claimed for these materials over PVC are impact resistance, especially at low temperatures; absorbtive ability; processing ease; and plasticizer tolerance with minimal embrittlement. Hostalit Z is marketed in two series, and is recommended for application in bottles, wire insulation, tubing, profile extrusion, calendered sheet, blocks, and plates.

german polycarbonate

Farbenfabriken Bayer A. G., Leverkusen, is producing Makrolon, a high-melting range polycarbonate based on 4,4'-dioxydiphenyl-2,2-propane (bisphenol A). It is said to exhibit an unusual combination of outstanding qualities, especially low temperature impact resistance. Even at —197° C., Makrolon will not fracture. Applications include pipe, blown film, blow-molded bottles and containers, mechanical precision parts, helmets, household and camping equipment, laboratory utensils, and electrical goods.

italian petrochemical plant

Montecatini is building a new petrochemical plant at La Scorza near Brindisi. An estimated 700,000 tons of derivatives, including Moplen, polyethylene, synthetic fiber polymers, aldehydes, alcohols, and organic solvents, will be produced annually.

italian polypropylene textile fibers

Polymer Co. of Italy, an associated firm of Montecatini Soc. Gen., Milan, will begin producing polypropylene textile fibers in late 1959. Reported to be highly heat resistant, light weight, and strong, the fibers may be used in cotton-like and wool-like fabrics and in blends with natural cotton and wool for articles like suitings, blankets, and sweaters.

melamine production in spain

Unquinesa (Union Quimica del Norte de Espagna, S. A.) Bilboa, which last year announced that the first local manufacture of polystyrene, will expand its Axpo-Erandio factory to produce 1,000 tons of melamine annually.

netherlands plastics industry

Plastics imports and exports of the Netherlands increased during 1958. Western European countries supplied over 80% of the 46,100 tons of raw materials and semi-products imported. Exports amounted to 32,-800 tons. When the projected, first local polyethylene factory goes into operation, imports, especially from the U. S., are expected to fall. As a result of the European Economic Agreement, trade with member countries increased at a loss to others, chiefly England.

petrochemicals industry in australia

Vacuum Oil Co., Pty. Ltd. (subsidiary of Standard Vacuum, U. S.); **Union Carbide (Australia), Ltd.** (affiliate of Union Carbide Corp. of America); **C.S.R. Chemicals, Pty. Ltd.,** (owned jointly by Colonial Sugar Refining Co., Ltd., of Australia, and Distillers Co., Ltd., Britain); and **Dow Chemical Co.,** U. S., are participants in the plans for a L. 23,000,000 petrochemical industry for Australia, to be based on hydrocarbons available from Vacuum Oil Refinery, Altona, Victoria.

Vacuum Oil will build a plant for producing ethylene and butadiene, and another for making general purpose synthetic rubber. Ethylene from this source will be used in a Union Carbide plant to make low pressure polyethylene, and in a C.S.R.-Chemicals-Dow plant to make styrene monomer. C.S.R. and Monsanto, the two companies presently making polystyrene in Australia, have been importing styrene monomer. I.C.I.A.N.Z. (Imperial Chemical Industries of Australia and New Zealand) has been using molasses-derived ethylene in its manufacture of polyethylene.

polyethylene in great britain

Union Carbide Ltd. is augmenting its Grangemouth, Scotland, plant with another 30 million pound per year production unit, which is expected to be in production by 1960. Union Carbide Corp., of which the British organization is an affiliate, is also constructing units at Fawley, England; and in conjunction with Societa Edison of Milan and Societe Chimique des Derives du Petrole, S. A., respectively, in Sicily and Belgium.

plastics in south africa

Womilith Co., South Africa, an affiliate of **Farbwerke Hoechst,** Frankfurt, has reportedly begun production of polyvinyl acetate. Fiberglass-reinforced plastics are now being used for boats and building panels. Authorities in Gwelo, Southern Rhodesia, plan to experiment with the construction of cheap plastic houses for African workers.

portuguese plastics plant

Resinas Sinteticas, Ltd. (Resintela), recently opened Portugal's first plastics plant at Mato da Charneca, Mem Martins, near Lisbon. This is a joint enterprise of four local companies: Companhia Geral de Combustiveis, SARL; Sociedade Central de Resinas; Sepulabre Ltda.; and Soc. Comercial de Resinas. Reichhold Chemie A.G. is technical advisor. Formerly all resin material had been imported into Portugal, as are most finished items.

purchase of mexican company

Polimeros S. A., a manufacturer of vinyl acetate polymers located in Mexico City, has been purchased by and will operate as a wholly owned subsidiary of **National Starch and Chemical Corp.** Donald A. Reese will continue as president of Polimeros. Although production has been used largely in the manufacture of latex paints, additional equipment will permit production of a complete line of vinyl acetate polymers and copolymers.

reinforced plastics in australia

Glass Fiber (Australia), Pty. Ltd., New South Wales, and **A.C.I. Fiberglass, Pty. Ltd.** (jointly owned by Australian Consolidated Industries and Owens-Corning Fiberglas Corp., U. S.), Melbourne, Victoria, are the two Australian companies now in agreement with Owens-Corning to produce fiberglass products. Glass Fiber is already producing chopped strand mat, and A.C.I. will manufacture continuous glass textile filaments. Imported fiberglass-reinforced resins are now being used in the boat, automobile, airplane, and building industries.

west german plastics trade

German production of plastics materials in 1958 increased by 15% to reach 645,329 metric tons. Imports rose over 26% to 104,971 metric tons, while exports jumped almost 36%, to 213,202 metric tons.

montecatini american plant

Montecatini has begun construction of a $10-million polypropylene and other polyolefines plant near Huntington, W. Va. A 200-acre tract has been acquired on the Big Sandy River at Neal, and completion is expected within two years. The firm's American subsidiary, Novamont Corp., will operate the plant, which will have an initial capacity of 10-million pounds annually. Montecatini headquarters are located in Milan, Italy.

new plants and laboratories

Carlon Products Corp., Aurora, O., has purchased new plant facilities in High Springs, Fla. Covering 100,000 square feet, the plant reportedly will be the biggest plastic pipe factory under one roof in the world. Production is currently underway.

Claremont Pigment Dispersion Corp. has broken ground for a 10,000 square foot addition to its plant at Roslyn Heights, L. I., N. Y. Increased demands for metallic colorants reportedly have necessitated this expansion of manufacturing facilities.

Dow Chemical Co. plans to spend $12-million on new construction for its Louisiana division at Plaquemine. Plans call for the erection of a polyethylene plant and facilities to produce vinylidene chloride and Chlorothene. The former should go on stream in about 18 months, the latter by mid-1961.

Modern Plastic Machinery Corp. has acquired a 80,000 square foot plant at 64 Lakeview Ave., Clifton, N. J. Formerly occupied by **Curtiss-Wright Corp.**, the plant triples MP's facilities. It should be in complete operation before the end of summer.

Morningstar-Paisley recently completed construction of a polyvinyl acetate emulsions plant in Clifton, N. J. The new facility should give Eastern users faster delivery, plus closer contact with the firm's technical service and production departments. This 50% increase in facilities, added to a 50% upping in output at the Chicago plant, means a doubling of Morningstar's total production.

American Cyanamid Co.'s pigments division has established a sales and warehousing facility in Charlotte, N. C. F. A. Sauter has been named sales representative in charge of the operation.

Comco Plastics, Inc., has moved to new quarters at 98-34 Jamaica Ave., Richmond Hill, N. Y. New facilities are four times the size of the former, and should enable the firm to speed deliveries through use of a motorized conveyor system.

Dobeckmun Co.'s branch office in Charlotte, N. C., has moved to larger quarters at 104 Washovia Bank Building. The new offices consolidate the firm's activities under the same roof with the parent firm, **Dow Chemical Co.** The old address was 221 S. Church St.

Dow Chemical Co. plans to build a polyethylene film plant near Fresno, Calif. Completion is expected early in 1960. Plant offices, manufacturing facilities, and warehouse will occupy about four acres of the 24-acre site. Initial employment should be about 100.

Emery Industries, Inc., has moved its branch sales office from Lowell to 751 Main St., Waltham 54, Mass. The new telephone number is Twinbrook 3-6358.

Escambia Chemical Corp. plans to erect new facilities at Pensacola, Fla., which will boost its methacrylic acid production to 500,000 pounds per year. The firm has developed a new method of producing the material—nitric acid oxidation of isobutylene, followed by dehydration of the resulting hydroxyisobutyric acid.

Houghton Laboratories, Inc., has completed a 4,300 square-foot warehouse at Olean, N. Y., complete with new truck loading docks and railroad siding. Additional expansion plans call for the erection of a building to house explosion-proof equipment, a 20% increase in production area, and a new shipping department.

H. Kohnstamm & Co., Inc., has established new headquarters at 161 Avenue of the Americas, New York City.

Logo Division, Bee Chemical Co., has set up quarters on the West Coast at 17000 So. Western Ave., Gardena, Calif. The Chicago firm now has a warehouse for coatings and finishes plus a sales service laboratory. The operation will be under the direction of Milton T. Schimmel.

society news

SPE Automotive RETEC

Over 400 members and guests attended the SPE Regional Technical Conference of "Plastics for the Automotive Industry," which was held at the Sheraton Cadillac Hotel, Detroit, Mich., on June 30. The morning session was moderated by Philip Weiss, General Motors Co., and featured three talks; the third including a panel.

Roy Deane, Spiratex Co., addressed the group on "Evaluation of Plastic Tubing for Automotive Purposes," outlining current applications and pointing out 15 areas for the possible use of plastics. Three Rohm & Haas men, R. L. Gardner, D. A. Hurst, and J. F. Woodman, covered the "Cost Advantages of Plastics in Replacement of Die Castings." They concluded that wherever the properties of conventional or high-impact acrylics or reinforced polyesters are admissible, they are likely to offer savings in cost over die castings. T. H. Risk, G. M. Buehrig, and the panel discussed "Linear Polyethylene Molding of the Side Seat Shield for the 1960 Ford." The piece was shown and its advantage cited. It was injection molded, and the cycle, mold, and production problems were described.

Luncheon speaker, Robert E. Burk, of Du Pont, spoke on the "Dynamic Growth of Plastics in European Cars," reporting what plastic materials are used in what application by car company. "Blow Molding with High Density Polyethylene" was covered by Thomas W. Mullen, Celanese Corp. of America, in the afternoon session. He described the process, its possible advantages, and automotive applications which might be used in the near future.

The conference closed with a panel discussion on "The Difference in the Domestic and Foreign Outlook on the Uses of Plastics in Automobiles," moderated by Harry McGowan, Union Carbide Plastics Co. It would seem that foreign car manufacturers are more receptive to trying plastics whenever possible, and the French actually brag about the number of plastic parts in the Citroen.

Vacuum Coaters To Meet

The Society of Vacuum Coaters will hold its next technical conference on January 26-27 in New York City. For more info, write to John Scharnberg, Bee Chemical Co., 12933 S. Stony Island Ave., Chicago 33, Ill.

SPE Detroit Section

SPE's Detroit Section has elected three new members to its board of directors: Gerald D. Gilmore, vice president of Bopp-Decker Plastics; Frank S. Marra, advertising manager of Detroit Mold Engineering Co.; and Ernest F. Widlund, district sales manager for E. I. du Pont de Nemours & Co. Gordon B. Thayer was elected sectional president.

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Like a peek over our shoulder at part of a report sent in recently by Bee representative Lee Dickinson?

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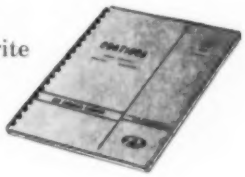

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Names in the News

James H. Hibben, chief of the Chemical Division of the United States Tariff Commission and one of the foremost chemical consultants in the United States, died on June 15 from injuries suffered during a fall at his home the previous day. He was 62.

As chief of the chemical division, Dr. Hibben was responsible for supplying government and industrial officials with basic and authoritative information. The author of many books and papers, Dr. Hibben was well-known for his studies on the raman effect, a type of secondary radiation which makes it possible to study the behavior of atoms within the molecules and the molecules themselves independently of their state of aggregation. Dr. Hibben's "The Raman Effect and Its Chemical Application" was one of the first definitive works on this subject, and his "Raman Spectra" is still the starting point for much of this work.

A graduate of the University of Illinois and the University of Paris, Dr. Hibben was a member of the Washington Academy of Sciences, New York Academy of Sciences, the Cosmos Club, American Chemical Society, Chemical Society of Washington, Sigma Xi and Sigma Chi; and a former Fellow of the American Institute of Chemists. He had also been a fellow of the International Education Board at Paris, a National Research Fellow at Princeton, Consultant to the Bureau of Standards, and a member of the research staff of the Geophysical Laboratory, Carnegie Institution of Washington.

Dr. Edward T. Severs and **Edwin M. Irish, Jr.,** have been appointed product managers at AviSun Corp., a newly created affiliate of the American Viscose Corp. and Sun Oil Co. Dr. Severs is now manager of the film division. He had previously been product manager in the polymer division, a position which is now held by Mr. Irish. Mr. Irish formerly served as manager of phenolic products sales in the chemical and metallurgical division of General Electric.

Carl B. McLaughlin has been elected president of Tube Turns Plastics, Inc., Louisville, Ky. A metallurgist-engineer, he headed the engineering service of what is now the Tube Turns Division of Chemetron until elected executive vice president of Tube Turns Plastics at its founding in 1954. He succeeds George O. Boomer, who has become chairman of the executive committee.

David A. Yeomans has been named production manager of Fabricon Products' impregnating division. He is returning to the company after a two year absence. **John T. Watkins, Jr.,** has been appointed assistant to the vice president. He was previously an industrial resin sales representative for the Monsanto Chemical Co.

James E. McDonell has been appointed plants manager, supervising production at Chippewa Plastics. Mr. McDonell's successor as production manager of the company's new First Avenue plant is **Norman Boos. Jack Nelson** has been promoted to the position of plant superintendent at Chippewa's Howard Street plant. All three have been with the company for several years.

James W. Ferguson

James W. Ferguson has been promoted to manager, field sales, of the Hooker Chemical Corp.'s Durez Plastics Division. Mr. Ferguson has been with Durez since 1931 as a chemist, technical service representative for resins, and assistant product manager of industrial resins.

Millard Demarest has been named sales manager of Auto-Vac Co., a division of National Tool Co. He was previously associated with Celanese Corp., Extrusions, Inc., and Welding Engineers, Inc.

Robert J. Prochaska has been appointed advance development specialist in General Electric Co.'s chemical materials department, polycarbonate engineering section, at Pittsfield, Mass. Dr. Prochaska has served with the firm since 1951 in technical service, sales, and advance development projects.

Al Dames

Al Dames has been appointed sales manager of Hastings Plastics, Inc., of Santa Monica, Calif. Mr. Dames has specialized in the design and construction of plastic tools, and has recently been active in the basic resin and chemical field.

Carl Tauch has been named production manager for Lone Star Plastics Co., Inc. He has previously been in estimating and production engineering with the Mosites Rubber Co.

Arthur H. Johnson has been named chief chemist of the product development division of the G. T. Schjeldahl Co., Northfield, Minn. He formerly served in the research department of the Kendall Co.'s Bauer & Black Division.

R. K. Senn has been appointed manager, extruder sales division of National Rubber Machinery Co., replacing Hans Buecken. **Len Turk,** previously coordinator, has been made operating manager of extruder sales. **J. F. Stroup,** lately of Goodyear Tire & Rubber Co., has recently been added to NRM's engineering staff.

Daniel J. Gowman has been named assistant vice president in charge of Sartomer Resins, Inc.'s Essington, Pa., plant. **John A. Cornell,** formerly director of polymer research, H. D. Justi & Son, Inc., has been named director of research.

Wilfred M. Bywater, administrative supervisor in the research and development department of the plastics and coal chemicals division, has retired after 41 years with Allied Chemical Corp. He has held various technical positions in Allied's research and manufacturing departments.

Albert W. Fuhrman has been appointed vice president in charge of the chemical division at Great American Plastics Co., Fitchburg, Mass.

NEW:

ESCAMBIA tests ways to eliminate air cavities, speed production, improve products

Tests with new vacuum hopper equipment are opening the door to volume production of improved extruded products using ESCAMBIA PVC resins in dry blends.

The end products are remarkably free of costly imperfections due to air contamination because the vacuum hopper removes the air from dry blends before they enter the extruder. In this, as in other applications, ESCAMBIA PVC resins give the additional benefits of outstanding heat stability, excellent color, clarity and surface gloss.

This new test program is in line with ESCAMBIA's policy of maintaining the very latest processing and testing equipment in its Technical Service Department. For details on how this test program can help you produce better products, contact your ESCAMBIA sales representative or write Department T at the address below—

ESCAMBIA
CHEMICAL CORPORATION
261 Madison Avenue • New York 16, N. Y.
New York Telephone • OXford 7-4315

MANUFACTURERS OF: PVC Pearls*/ ESCAMBIA* PVC Resins/ BAY-SOL* (Nitrogen Solutions)/ AMMO-NITE* (prilled ammonium nitrate fertilizer)/ Anhydrous Ammonia/ Ammonia/ Nitric Acid/ Methanol

*Trademarks of Escambia Chemical Corporation

New Materials

Write item numbers on Readers' Service Card (p. 85) to obtain more information.

Rubber-based Tile Adhesive

Armstrong Cork Co. is selling a long tack range, good aging, and non-bleeding adhesive designed for installing polystyrene wall tiles or extruded polystyrene panels on wood or metal surfaces. The adhesive, G-386, reacts chemically with the back of the plastic after prolonged contact to form an inseparable bond. C-386 reportedly yields bonds many times stronger than can be obtained with any oleoresinous or oil-based mastic.

Tiles may be set up to 12 hours after the cement is spread. Priming is not required on white coated plaster or plasterboard. The white adhesive will resist water and oxidation; it can be removed with petroleum naptha. The service temperature range is —40 to 140° F.

G-386 can be applied with a trowel. One gallon covers about 60 square feet and has a shelf life of about nine months. The adhesive will be sold in three gallon pails; one gallon cans shipped four to a carton; and one quart cans shipped 12 to a carton.

Readers' Service Item 1

Protective Hand Lotion

A lotion which is reported to be a skin rash preventive against epoxies, polyester resins, and other toxic chemicals, is being marketed by Vanfaire Co. Called Vanfaire, the lotion is soluble in soap and water, and protects the hands for up to 12 hours.

Readers' Service Item 2

Ultraviolet Light Absorber

An ultraviolet ray absorber, expected to be useful on polyethylene and polypropylene products for outdoor use, will be available early next year. Known as UV 314, the product, 2,2'-dihydroxy-2-n-octoxy-benzophenone, is reported to have low volatility and high compatibility in polyethylene.

According to the producer, American Cyanamid Co., the light-stabilized plastics are expected to be used in marine ropes, fabrics for automotive upholstery and lawn furniture, mulching and greenhouse sheeting, tarpaulins, high altitude balloons, and moisture barriers for building construction.

UV 314 is a pale yellow powder that absorbs strongly in the 300-375 millimicron range of the ultraviolet. Its long alkyl group (n-octyl) at the ether linkage makes it compatible with polyolefins.

Readers' Service Item 3

Synthetic Magnesium Silicate

American Industrial Chemical Co. is producing several grades of adsorptive magnesium silicate under the trade name AICCO-SOL. A porous, finely-divided, free-flowing white powder, its recommended uses are: removing impurities from natural and synthetic organic chemicals; curing plastics and preventing blisters during molding; controlling thixotropy of plastic coating; retaining moisture in powdered products; preventing caking in plastic molding compounds, detergents, etc., and catalyzing. Although soluble in strong acids, the silicate adsorbs water and weak acids. It displaces heavy metal ions in salts, but exhibits no reaction in bases. Properties are:

Density	2.04
Specific area, m^2/g	600
Refractive index	1.500-1.515
Pore volume, ml/g	600
Average dia., A^0	33

Readers' Service Item 4

Two B-C-Z Stabilizers

Two liquid barium-cadmium-zinc stabilizers for vinyl compounds are currently available from Ferro Chemical Corp. Ferro 1234 is recommended for use in calendering, extruding, and molding plasticized, unfilled flexible formulations. It can, however, be used in filled and pigmented flexibles, and in plastisols. Nonplating, 1234 has a very low level of sulfur staining, excellent storage stability, and requires only ¼ phr. of stearic acid for maximum stabilization at any concentration level. Low in cost, it combines good, early color retention with clarity and long-term heat stability.

Ferro 1237 is designed for processing plasticized, filled, and pigmented vinyl formulations. In calendering, molding, and extruding it provides exceptional early color retention in white and pastels, as well as the darker colors. Ferro 1237 is compatible with all common primary plasticizer systems, produces good light stability, is non-sulfur staining, non-plating, has good air release and viscosity in plastisols, and also requires only ¼ phr. stearic acid for maximum stabilization.

Both materials are amber in color and possess the normal toxicity of barium and cadmium compounds. Density of 1234 is approximately nine pounds per gallon; about 8.5 for 1237.

Readers' Service Item 5

Six Synthetic Fiber Types

Six polyethylene and polypropylene fibers have been introduced by the footwear and general products division of U. S. Rubber Co., under the treadname Royalene. They are offered round, flat, oval, and ribbon shaped, in sizes from 6-35 mils, and in nine colors.

The Royalene types include: A TYPE A linear polyethylene of high strength, heat, abrasion, and chemical resistance; type C polyethylene compounder for shrinkage, heat and chemical resistance; type E polyethylene with high shrinkage in boiling water; type L polyethylene for electrical applications; type P polypropylene for higher heat resistance and resistance to creep under loading; and type N copolymer polyethylene which retains the physical properties of the highest grade linear polyethylene plus superior resistance to creep under load.

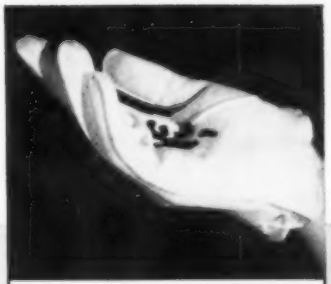
Colors include clear, white, yellow, orange, red, maroon, blue, green, and black. Lab reports show no color change after 200 hours in a standard fadeometer. Suggested end uses include nautical ropes, decorative screening, shoe webbings, flat ropes, tow targets, handbag fabrics, upholstery, and outdoor furniture webbing. The C & E compounds are currently used by U. S. Rubber's textile division to make Trilok, the three-dimensional fabric.

Readers' Service Item 6

From here to here

COLUMBIAN dispersed CARBON BLACK is designed for QUALITY... EFFICIENCY... PROFIT

Uniformity of color (mass tone and tint) ... controlled compatability with your media ... assured stability in your system.



Short clean-up time ... no contamination of tight colored stocks in production area ... increased mixing capacity (just blend them in).

All the advantages of Columbian dispersed black add up to a quality controlled product with less black ... with less work ... for more profit.

There's a Columbian black dispersion to meet your most exacting coatings, plastics or aqueous requirements ... to give you unsurpassed product quality ... efficiency ... profit.

COLUMBIAN CARBON COMPANY
380 Madison Avenue, New York 17, N. Y.

CARBON BLACK DISPERSIONS FOR EVERY NEED ... Coblac® • Covarnishblak® • Cowaxblak® Globlak® • Coresinblak® • Costyreneblak® • Covinylblak® • Coethloblak® • Copeenblak® • Aquablak® • Hiblak®

Vinyl-To-Metal Adhesive

A new adhesive for bonding vinyl to steel has been introduced by F. B. Goodrich Industrial Products Co. Called A-978-B Cement, the adhesive's bond has withstood boiling in water for 30 minutes; exposure to 200° F., for seven days; and humid storage at 160° F., for 1,000 hours. Sheet steel bonded to vinyl with A-978-B can be stretched 35% without weakening the bond or damaging the vinyl coating.

The cement permits sheet steel to be vinyl-coated, embossed, and then deep-drawn without damage to the adhesion. This method reportedly is faster and more economical than drawing the metal and finishing it later. It is available to basic steel producers and converters; and industrial users may obtain it alone or with a BFG plastisol.

Readers' Service Item 7

Self-Extinguishing Laminate

XXXP-grade laminated plastic for electrical applications subject to high humidity is currently available from Continental-Diamond Fibre Corp. Made from cellulose paper impregnated with epoxy resin, the laminate is marketed in plain sheets (Dilecto XXXP-31EFR) and copper-clad sheets (Di-Clad 31EFR).

The laminate is flame-retardant, and remains rapidly self-extinguishing after five ignitions. It is used as insulation for computers, radios, telemetering equipment, and guidance units. Water absorption is a mere 0.35% after 24-hour immersion. Other features include excellent cold-punching qualities and lightness. Color is natural (cream), finish is semi-gloss, and the thickness range is 0.015 through 0.25 inch. The two standard sheet sizes are 38 by 42 inches and 38 by 38 inches.

Specifications include the following:

Insulation resistance, megohms	1,000,000
Dielectric strength, parallel to sheet, step by step, kv	70
Perpendicular to sheet, short-time, vpm	650
Arc resistance, sec	6
Surface resistance, megohms	100,000
Dielectric constant, 1 mc	4.1
Dissipation factor, 1 mc	0.031
Tensile strength, psi., lengthwise	12,000
Crosswise	9,500
Flexural strength, psi., lengthwise	23,000
Crosswise	19,000
Compressive strength, crosswise, psi.	30,000
Hardness, Rockwell M	100
Maximum continuous operating temperature, °F	248

Readers' Service Item 8

When the problem is inorganic pigments and extenders for compounding plastics...

WILLIAMS invites you to take advantage of its 80 YEARS EXPERIENCE

Today Williams offers a complete line of inorganic pigments and extenders for the plastics industry. All have color permanence and chemical stability. Here is a representative list of these products.

Pure Red Iron Oxides • Pure Yellow Iron Oxides • Pure Black Iron Oxides • Pure Brown Iron Oxides • Pure Chromium Oxide Greens • Pure Hydrated Chromium Oxides • Umbers • Siennas • Lampblack • Anhydrous Calcium Sulfate • Barytes • Calcium Carbonates

Send today for detailed Technical Reports which give you complete description of the chemical and physical properties of each. Address Department 37, C. K. Williams & Co., 640 N. 13th Street, Easton, Pennsylvania.

WILLIAMS
COLORS & MINERALS
C. K. WILLIAMS & CO.
E. St. Louis, Illinois • Easton, Pennsylvania • Emeryville, California

High-Hydroxyl Pentaerythritol

Pentaerythritol No. 681, a recent introduction by Reichhold Chemicals, Inc., is said to feature high hydroxyl content, low ash, and absence of fine dust. It has been used successfully in alkyds, drying oils, oil-bearing esters, paints, and vinyl plasticizers.

Physical properties are reported as follows:

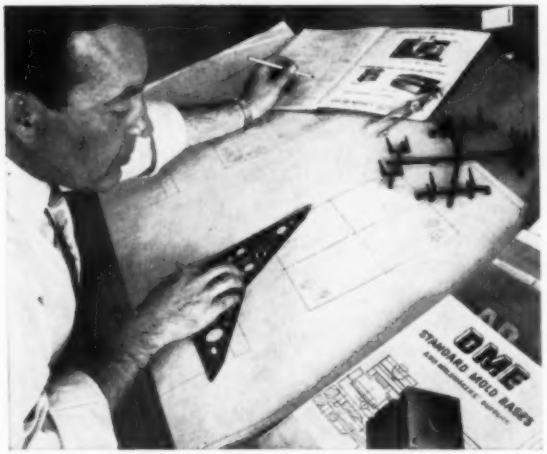
Appearance	White
Monopentaerythritol content, %	86-90
Hydroxyl content, min., %	47
Ash content, %	0.002-0.01
Non-volatiles, %	99.5
Melting point, °C	240
Specific gravity	1.38
Bulk density, lbs./cu. ft.	40

Readers' Service Item 9

Epoxy-Polyamide Repair Kit

A two-component repair kit for flooring, walls, ceilings, driveways, curbs, masonry, pipes, furniture, and a myriad of other uses has been introduced by Williamson Adhesives, Inc. Formulation is such that equal parts of the white epoxy base and the black, polyamide-containing hardener to obtain a neutral gray composition which set in about four hours at room temperature.

MOLD DESIGNERS



SAVE MORE ON MOLD COSTS With Over 6,000 D-M-E Standard Mold Bases to Choose From

Whether it's a one-cavity "test" mold or a 60-cavity high production run, chances are D-M-E has the right size Standard Mold Base to fit the job and the molding machine.

D-M-E's 32 standard sizes, up to 23¾" x 35½", with 100 standard cavity plate combinations for each size, give you the largest selection of carbon or alloy steel standards available from any single source.

Save on Design and Moldmaking Time, Replacement Parts and Delivery

Design time is reduced by using D-M-E's full-scale Master Layouts and Catalog of specifications and prices. Moldmaking time is reduced because all D-M-E plates are precision ground flat-and-square, ready for cavity layout and machining. Exclusive interchangeability gives you the added saving of immediate replacement of any component part. And D-M-E's seven branch offices and warehouses are always fully stocked with Standard Mold Bases and components to meet your delivery requirements.

Cut Costs on Your Next Program

Start saving on your next moldmaking program, no matter how large or small. Take advantage of D-M-E Quality, Service and Economy.

Faster deliveries from complete stocks
Over 1,000 D-M-E Standard Mold Bases always IN STOCK at local D-M-E Branches for IMMEDIATE DELIVERY.

DME DETROIT MOLD ENGINEERING COMPANY

- DETROIT: 6686 E. McNichols Rd.—CHICAGO: 5901 W. Division St. HILLSIDE, N.J.: 1217 Central Ave.—LOS ANGELES: 3700 S. Main St.
- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

PROTECT PROFITS with *Logan*

Logan brings you advanced design that assures lower cost production. Our free and detailed analysis will prove this to you.

HYDRAULIC PREFORMERS

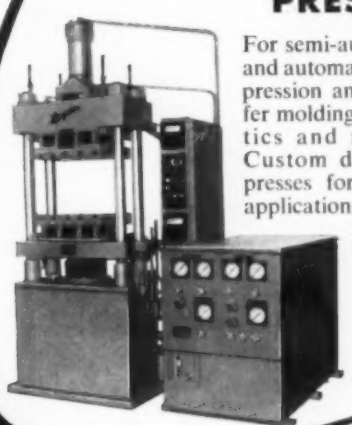
They may be used for handling the entire range of materials from G.P. phenolics to higher impacts that are rag filled.

Capacity range: 30 to 125 tons.

HYDRAULIC PRESSES

For semi-automatic and automatic compression and transfer molding of plastics and rubber. Custom designed presses for special applications.

Capacity: 10 to 400 tons.



Write for new catalog describing the latest in Logan equipment.

LOGAN HYDRAULICS, INC.

A SUBSIDIARY OF LOGAN ENGINEERING, CO.
4901 WEST LAWRENCE AVENUE
CHICAGO 30, ILLINOIS

Temperature extremes—
which can rob vinyls of flexibility—are of little concern to producers who specify Plastolein low temperature plasticizers for their products. For example . . .

They know that Plastolein 9058 DOZ is the time-tested standard of the low temperature plasticizer field . . . that it provides the kind of low temperature flexibility *that stays in* their vinyls even after prolonged exposure to summer heat.

And more and more producers are utilizing the unusual capabilities of another Emery plasticizer, Plastolein 9078 LT, which approximates 9058 performance, but at a much lower price.

Why don't *you* investigate the advantage of these Plastolein Plasticizers in your coated fabrics, film, sheeting and extrusions?

Write Dept. Q8 for literature.

PLASTOLEIN® plasticizers

Emery

Organic Chemical Sales Department
Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio
Vopcolene Division, Los Angeles
Emery Industries (Canada), London, Ontario
Export Department, Cincinnati

Speed of reaction depends, of course, on the amount mixed as well as the temperature. Cure is considerable speeded by the application of heat. Mixing of components is easy and fast due to the wetting capacity of the polyamide. Cured, the Plastic Mastic, as it has been tradenamed, can be sanded, drilled, or machined to a smooth surface. It is non-flammable and contains no volatile solvents.

Features claimed for Plastic Mastic include long shelf life, bondability to almost every known material, resistance to weathering and chemicals, and rust inhibiting properties. A strength comparison with concrete reveals the following:

	Plastic Mastic	Concrete
Hardness, Rockwell M	71	64
Shrinkage, in./in.	0.001	0.0012
Compressive strength, psi.		
After 3 days	6,610	3,110
After 7 days	8,260	3,590
After 28 days	8,270	3,730
Abrasion resistance, loss/1,500 cycles, in.	0.0085	0.0255
Tensile strength, psi	1,480	450
Adhesion to steel, psi	1,260	Specimen breaks
Dielectric strength, ASTM D-149	430-470	Not applicable

Readers' Service Item 10

Parting-Mold Release Agent

A parting solution and mold release agent has been introduced by the Mol-Rez division of American Petrochemical Corp. Called Pleogen 3000-1, the material sprays easily and lays down over most waxes to give a smooth surface without runs, sags, bubbles, or pinholes. It dries rapidly (15-30 minutes) to a glossy film which washes off quickly with water.

Gel coats can be laid down over Pleogen 3000-1, and the reinforced plastic parts release easily. It comes as a green colored solution packed in polyethylene pour spout cans.

Readers' Service Item 11

Improved Acrylic Compound

A new grade of acrylic molding powder, Plexiglas V (Type 811), has been introduced by Rohm & Haas Co. Prime feature reported for the material is its exceptional stability at high molding temperatures. In addition to reduced rejects due to splash, field tests have shown less cracking of parts on ejection, fewer weldline and tail problems, and shorter cycles in some molds.

Average physical properties are reported below:

Refractive index, ASTM D-542-42	1.49
Specific gravity	1.19
Tensile strength, psi	9,000
Flexural strength, psi	16,000
Compressive strength, psi	17,000
Impact strength, Izod, ft. lbs./in. notch	0.4
Hardness, Rockwell M	92
Light transmission, %	93
Heat distortion temperature, °F	196
Flow temperature, °F	316
Shrinkage from mold dimensions, mils/in. 48 hrs.	5-8
Deformation under load, %	0.3
Dielectric strength, V/mil	500
Dielectric constant	2.2
Power factor	0.03
Loss factor	0.06
Arc resistance	No tracking
Flammability, in./min	0.7

Readers' Service Item 12

Epoxy-Paper Base Laminate

Phenolite Grade EP-491 is the designation given National Vulcanized Fiber Co.'s new premium-grade epoxy-paper base laminate. Special features claimed for the material include excellent flame resistance, exceptional cold punching quality, electrical properties superior to regular XXXP types, and better dimensional stability.

Specifications are reported as follows:

Thickness range, in.	$\frac{1}{32}$-$\frac{1}{4}$
Sheet sizes, in.	39 x 47 & 39 sq.
Color	Cream
Punching temp., °F	75
Burning time after 10 sec. exposure to Bunsen flame, sec.	<1
Flexural strength, psi	18,000
Impact strength, ft. lb./in.	0.63
Water absorption, %	0.3
Dissipation factor, 1 megacycle	0.03
Dielectric constant, 1 megacycle	4.1
Hardness, Rockwell M	102
Dielectric strength, V/mil. Cond.	
A Perp. to laminations	880
Parallel to laminations	60
Arc resistance, unclad, $\frac{1}{8}$-inch	64

Readers' Service Item 13

Polyester Type Plasticizer

A polymeric plasticizer which lends permanence to vinyl compounds and is resistant to migration into lacquers, varnishes, and polystyrene has been developed by The Harchem division of Wallace & Tiernan, Inc. Called Harflex 330, it features low volatility, low extraction, and good electrical properties.

Typical specifications and properties are reported as follows:

Color, Gardner, max.	5
Acid value, max.	2
Specific gravity, ± 0.003	1.08
Viscosity at 210°F., ± 5	185
At 100° F., ±60	2,340
Refractive index	1.466

Readers' Service Item 14

"...Emery plasticizers in our

federan®

give us excellent results at economical prices."

Dr. Ernest Seaman, Research & Development Director, Federal Industries, Belleville, New Jersey, says:

"As my title implies, I am responsible for maintaining our enviable reputation for high quality as well as the outstanding performance of FEDERAN, a vinyl coated fabric made to meet the most exacting customer and consumer requirements.

"In my research work, I have found that Emery plasticizers give us excellent results at economical prices.

"Our business relationship with Emery dates back over the past several years, and we have the utmost confidence in them as a supplier of top-grade plasticizers. They have continued to provide us with a uniform product of high quality, and in addition, they have consistently worked with us in the development of new and better plasticizers.

"Emery has been of considerable assistance to us in maintaining the leadership we enjoy for our line of FEDERAN plastic coated fabrics."

Where the accent's on quality
there's a preference for ***Plastolein® Plasticizers***

Emery

Organic Chemical Sales Department
EMERY INDUSTRIES, INC., CAREW TOWER, CINCINNATI 2, O.
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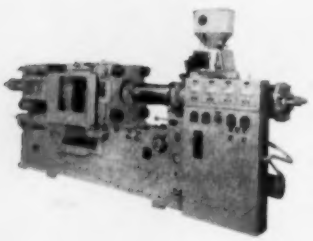
Export Department, Cincinnati

New Equipment

Write item numbers on Readers' Service Card (p. 85) to obtain more information.



Lombard Model 3220-125 12-16 oz. machine.

High Speed Injection Molding Machine

Lombard Governor Corp. has announced the development of a Hi-Speed 12/16 ounce injection molding machine, Model 3220-125, to supplement its present low-cost Model 3214-12 unit (see our May issue, pages 50-51). The new unit offers a 42-inch daylight opening, adjustable plunger speeds of up to 371 inches per minute, over-size plasticizing cylinder, dual injection pressure controls, and linkage speed control. Plunger advance; stuffing controls; manual, semi-automatic, or fully automatic cycling; automatic compensating weigh-feeder; interior and exterior knock-outs; and high-speed booster on linkage control are available as standard features.

Optional features available on request are impulse or precompressed molding unit; nylon shut-off valve; core-pulling attachment; mold opening slow-down; low pressure die closing; and mold stop control. The machine is equipped with a 100-pound material hopper, 150-pound per hour preplasticizing cylinder, a five-point interlock system for safety, and occupies 35 by 160 inches of floor space.

Readers' Service Item 21

Deep-Draw Injection Machine

Reed-Prentice division of Package Machinery Co. has brought out a new injection molding machine, the 275TA-8/10 oz. unit, which can handle larger molds and produce deeper sections. Mold platens measure 27 by 27¼ inches, and space between the 3½-inch diameter tie bars is 15½ by 15½ inches. Molds as large as 27 by 15½ inches can thus be accommodated.

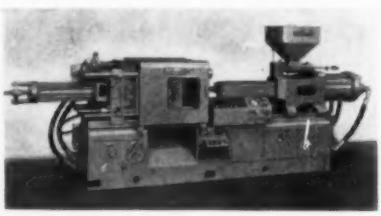
Other features of the machine include an 8-second dry cycle (470 cycles/hr.), 120 lb./hr. plasticizing capacity, 6¼-11½ inch clamping stroke, and 275 tons of positive mold clamping pressure. Plastic articles up to 5¾ inches deep can be molded on the 275 TA.

The front safety door is equipped with double limit switches and hydraulic lock. Limit switches are interlocked with a hydraulic arrangement which is self-monitoring. Hydraulic rather than mechanical means facilitate mold set-up and space adjustments. Movement of the plunger housing hydraulically prevents possible nozzle breakage during mold set-up.

All thermoplastics can be handled by the straight-bore heating cylinder, including vinyl and nylon. Rated in polystyrene, we get the 120-lb. plasticizing rate. A special reverse-taper heater nozzle is available for molding nylon, as well as a proportioning-type pyrometer and thermocouple. There are four heat-control zones; three on the heater, one on the nozzle.

Using two booster pumps, injection speeds up to 79.2 inches per minute can be obtained; with three, 148 inches. Standard injection rate is 800 cubic inches per minute; 1,600 with the optional prefill arrangement. Mounting of the 25-hp. motor, pump, and hydraulic manifolds on the machine base simplifies maintenance.

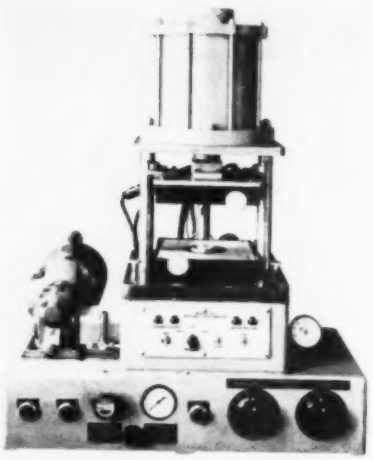
Other specifications include:



Reed-Prentice 275TA injection molding machine.

Hopper capacity, lbs	150
Injection pressure, psi	20,000
Injection force, total lbs.	113,100
Plunger diameter, in.	2⅝
Cylinder diameter, in.	12
Plunger stroke, in.	11
Plunger speed, in./min.	147.5
With prefill	294
Heater, Kw	17
Oil reservoir capacity, gal.	150
Length, ft.	18-2/3
Width, ft.	4-5/6
Height, ft.	6-5/6
Weight, lbs.	16,000

Readers' Service Item 22



Mooney Viscometer (right) and Recording Chart (left).

Automated Viscometers

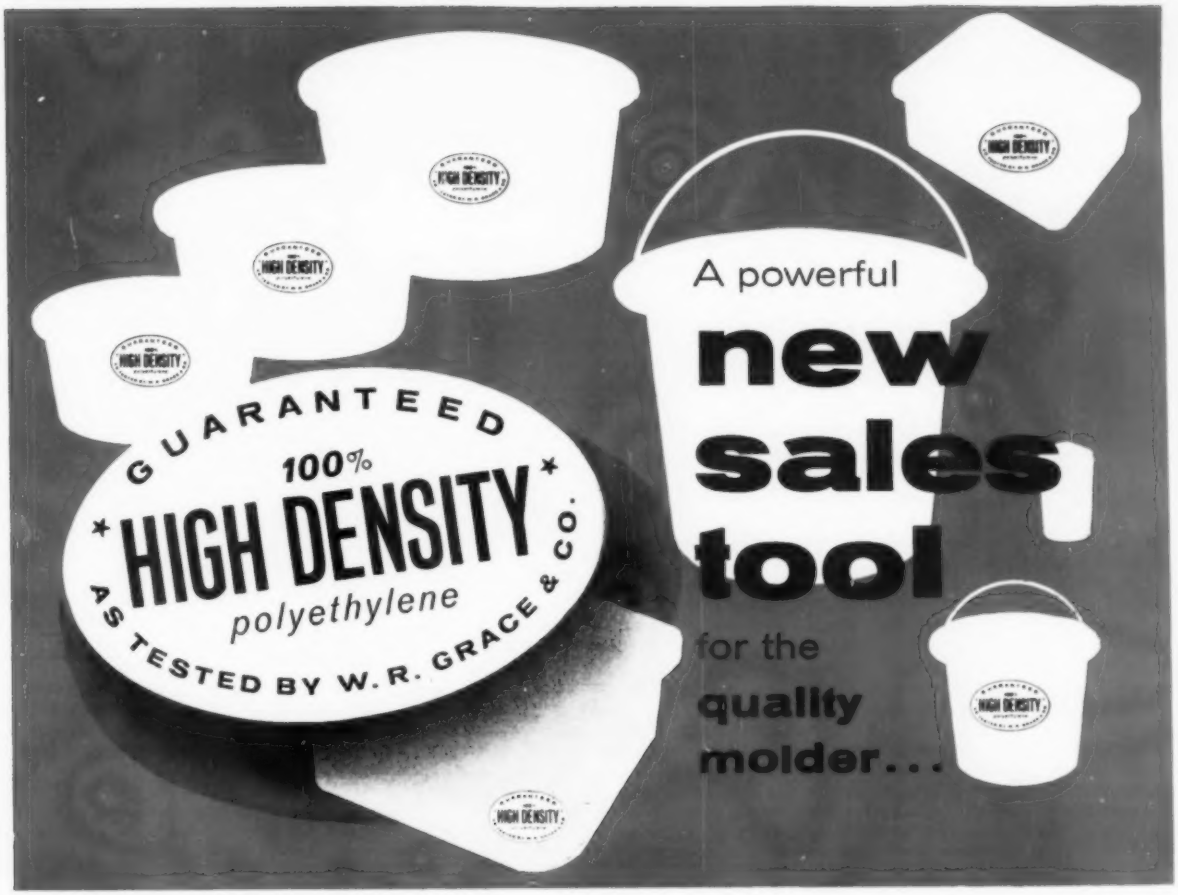
Automated operation of their Mooney Viscometers is announced by Scott Testers, Inc., with the claim that 75% of the operator's time may be saved thereby. This is made possible by the fact that after the operator inserts the test specimen and sets the controls in motion, the machine takes over and completes the viscosity test automatically. The automatic cycle includes a one-minute warm-up of the specimen; the test proceeds and the results are recorded; the test is shut off on the basis of elapsed time or viscosity rise (whichever occurs first governs the operation); and automatic recording of the test concurrently on the visual chart showing viscosity and elapsed time on the scale, with temperature also is recorded in synchronization.

The automated feature is applicable to both Models ST1 and NBS which yield Mooney-point values in accordance with ASTM methods. Model ST1 measures 36 inches high, 28 inches wide, 18 inches in over-all depth, and weighs 485 pounds. Model NBS has the following corresponding dimensions: 22, 24, 12, and 200.

Readers' Service Item 23

Electronic Embossing Sealer

A heavy-duty sealing unit designed for embossing and sealing of automotive plastic trim materials, such as door panels, seat inserts, sun visors, etc., has been developed by Reeve Electronics, Inc. Rated at 20-kw R. F. output and 20-ton total pressure, the press unit has a working plated space of 36 by 48 inches, a five-inch upacting stroke, and is equipped with automatic shielding doors on all sides. Loading shuttle supports are supplied on opposite sides of the press, with ball-bearing rollers.



from the makers of **GREX*** HIGH DENSITY POLYETHYLENE

An industry first! Designed to benefit the entire high density polyethylene industry, this label adds a new dimension to the W. R. Grace & Co. policy of helping the molder to sell *his* customers.

Through advertising, store buyers everywhere have been made aware that this "100% high density polyethylene" label on a plastic item is comparable to "sterling" on a silver item and "18 karat" on anything made of gold.

In brief, this label now signifies to the buyer that he is getting the very best in plastics . . . a quality item commanding a quality price.

To find out how this powerful new sales tool can be put to work for *you*, contact your local W. R. Grace & Co. representative. Or write directly to us.

**W.R. GRACE & CO.*
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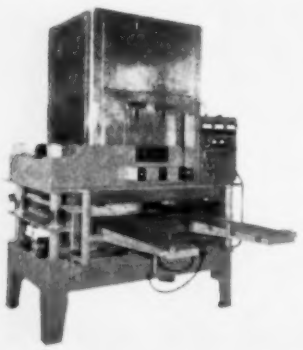
3535 W. PETERSON AVENUE, CHICAGO 45, ILLINOIS

Trademark for W. R. Grace & Co.'s polyolefins.



Reeve C-74 Embossing Sealer.

The bottom platen has depressable, spring-loaded, ball-bearing rollers.

The controls include pressure control, heat timer, plate current, platen voltage, grid current, and grid tuning. The output controls are motor-driven, push-button actuated with servo-positioning indicator meters. The unit operates on a 230/460-volt, three-phase, 60-cycle line, and utilizes a 120-psi. air supply.

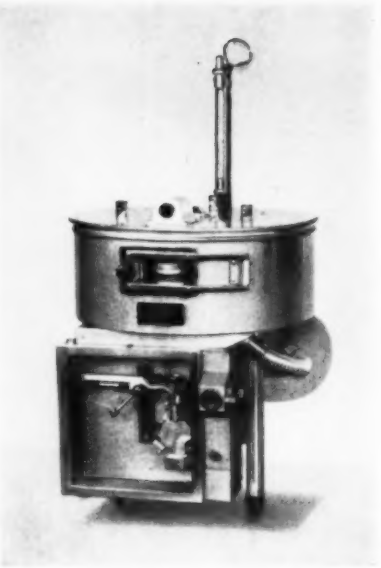
The C-74 sealer is 36 inches high, 24 inches deep, 30 inches high, and weighs approximately 750 pounds. Construction is of heavy-gauge, polished aluminum on a welded steel frame. Controls furnished include a variable vacuum capacity stepless control; automatic heat cycle timer; off-on switches with indicating pilot lights; meter and switch for checking plate and grid currents; manual or foot-operated air valve to open and close the press; circuit breakers; door interlocks; and insulated platens and dies. Optional equipment available includes RF voltmeter; arc suppressor; button-operated solenoid valve; air control assembly; and sealing dies and nest plate.

Readers' Service Item 24

Rapid Moisture Tester

Measuring moisture or volatiles content in material is a simple, rapid operation with a Rapid Moisture/Volatiles Tester, recently announced by C. W. Brabender Instruments, Inc. The unit is semi-automatic in operation, and eliminates the need for double weighing, desiccator cooling, and calculating. The manufacturer claims that an unskilled person can operate the device and obtain moisture or volatile content readings with an accuracy of $\pm 0.05\%$.

The Tester owes its speed and accuracy to an updraft baffle heat and magnetic damping features. The specimens being tested are weighed in 10-gram batches measured into special pans and, after given any pre-determined drying period, moisture percentages may be read directly from the scale.



Brabender Moisture/Volatiles Tester.

Typical applications for the test unit include rate-of-drying studies to establish curves for process and quality control;

Newest from National Lead

unique, balanced stabilizer

1

Make better plastisols

- New lows in initial viscosity
- Minimum buildup of viscosity on aging
- Improved air release

For more about INVIN 85 stabilizer and other chemical developments from National Lead Company, check and mail coupon below. Technical help in their application is yours on request.

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  - ☐ On stabilizers for other vinyl products (specify)_____
- **Folders on Gelling Agents:**
  - ☐ For gelling plastisols, organosols

Name_____ Title_____

Firm_____

City_____ State_____

determining optimum time-temperature drying conditions; stability testing of ingredients and additive used in compounds; and moisture testing to determine the need for drying of compounds in plastics molding. The percentages of volatiles given off may be used as an index of cure when molding alkyd resins. Polymerization control is achieved by taking moisture/volatiles readings.

The unit is 33 inches high, 22 inches in diameter, and weighs approximately 77 pounds. The tester is supplied with 10 aluminum sample dishes, and is furnished with thermoregulator ranges of 40-110, 75-175, and 100-200° C. A calibrated dish, four analytical weights, and tweezers mounted on a felt-clad block are supplied for the control and adjustment of the analytical balance. The complete tester operates on a 115-volt, 60-cycle, A.C. power supply, but can be furnished to operate on other power sources.

Readers' Service Item 25

Self-Contained Temperature Regulator

A new VU 82 Temperature Regulator for proportional control of water, gas, or low-pressure steam is available from Barber-Colman Co. The unit is designed for all applications where a self-contained valve assembly is suitable. Of a tight-closing, rugged construction, the regulator offers all the installation advantages of a self-contained controller, with the additional features of a clearly-marked, calibrated adjusting dial for precise temperature control, a rugged electrical industrial motor operator, and armored capillary tubing.

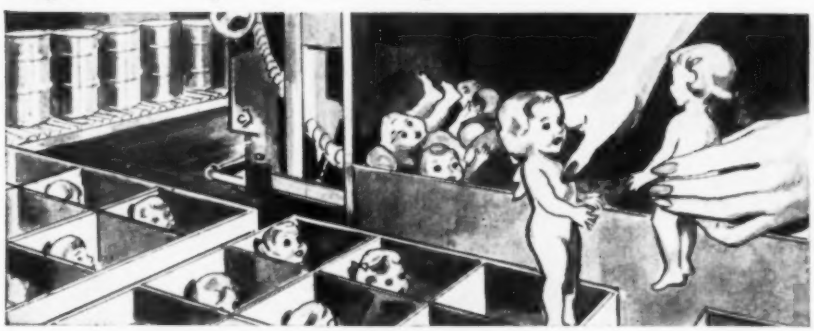
No assembly, linkage, or adjustment is necessary either before or after installation, except for the simple setting of the control dial to the exact required temperature. The regulator uses a two-wire connection to almost any available power source, and provides full power throughout the complete valve operating stroke. This assures positive valve positioning, tight closing, and closer, more accurate control for the user.

The valve is available in sizes from ¼-4 inches, and is of single-seat, V-ported type with a renewable composition disc for steam or hot water usage. The valve body is bronze, with a bronze trim in sizes from ¼-2 inches; iron body with bronze trim in the larger sizes. Motor and gear train are submerged in oil and sealed in a die-cast case, assuring long life with minimum maintenance. Cam-operated switches stop the motor in valve-open and valve-closed positions. The thermal element is of liquid-filled copper, with 10 feet of armored capillary tubing. A scale range of 10-90° F. is standard, but other ranges can be furnished to order, using a temperature differential of 1.5-2° F. The preferred mounting is with the valve stem upright, but other mountings can be used. The motor is detachable as a unit.

VU 82 Temperature Regulator.

Readers' Service Item 26

Research... INVIN* 85 especially developed to:



2

Make better finished products

- New highs in heat and light stability
- High resistance to sulfide staining

National Lead chemical research improves performance of many other vinyl products

National Lead chemical research develops stabilizers to improve all commercial vinyls. There are special stabilizers designed for electrical insulation, garden hose, stereo records, floor tile, strip coatings, upholstery sheeting, shower curtains. National Lead also has gelling agents which control sag, run-off and fabric penetration of plastisols, organosols.

*TRADEMARK

A Chemical Development of **National Lead Company**

111 Broadway, New York 6, N. Y.

Plastics Applications

Write item numbers on Readers' Service Card (p. 85) to obtain more information.

Phenolic spigot and key.

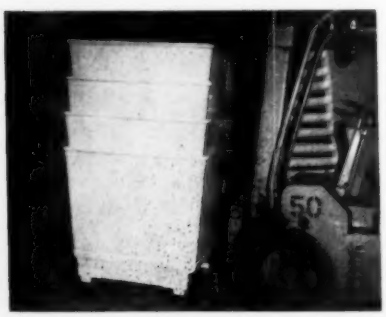
Spigot for Corrosive Liquids

Norton Laboratories Inc., is offering a phenolic spigot and key for use in the handling of bulk, corrosive liquids. The compression-molded spigot has a smooth bore with no cracks to gather contamination. The spigot is 9¼ inches long, is tapered from 1½ to ⅞ inch, and is drilled to a $^{9}/_{16}$-inch diameter. The key is tapered and opens and shuts with a half turn. The spigot was developed by National Aniline Division of Allied Chemical & Dye Corp.

Readers' Service Item 41

Material Handling Containers

Goodyear Aircraft Corporation is producing fiberglass-reinforced plastic bins capable of handling or transporting more than a ton of parts or material. Consisting of a plastic body with a separate base bonded on, the containers are smoothly mat-lined. Designed for rugged use, these strong, lightweight, easily handled bins are waterproof and can be steam-cleaned.



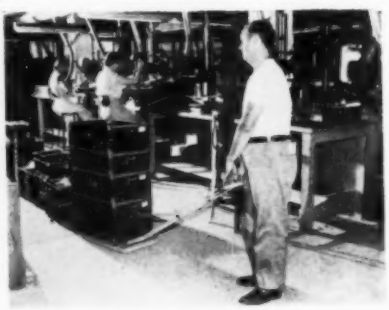
Goodyear plastic handling bins.

The bins are designed for handling with fork or bed lift trucks or hoist lift-bars. They measure four feet in length and 41.5 inches in width and 36 inches in depth, holding a volume of 33.5 cubic feet or 260 gallons, and come with 5, 7½, or 9½ inch legs. They have been approved by the Department of Agriculture as sanitary replacements for brine barrels.

Readers' Service Item 42

Inplant Tote Boxes

Kennett vulcanized fibre tote boxes are custom-built by the National Vulcanized Fibre Co. for inplant parts handling. Made of tough cellulose plastic, the boxes are metal reinforced at the corners and edges. The boxes are designed for multiple stacking, and have spring clips to hold marking tickets, and speed handling and identification. They are lighter than metal or wood equivalents.

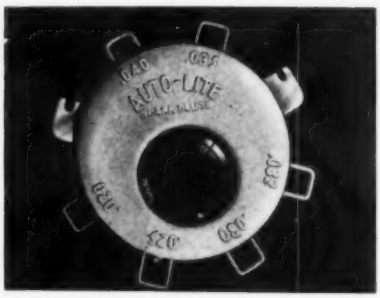


Kennett plastic boxes.

Readers' Service Item 43

Spark-plug Gap Gage

A circular, butyrate spark-plug gap gage with a built in steel wrench and methacrylate magnifying lens has been put on the market by the Electric Auto-Lite Co. The steel wrench is blanked into the shape of the letter "W," and runs through the plastic body. The six stainless-steel wire feelers around the rim of the gage are



Auto-Lite gage with wrench.

used to measure the amount of spark-plug gap. The finished gage, slightly larger than a half-dollar, is strong and durable. It was designed and manufactured by the Watertown Manufacturing Co.

Readers' Service Item 44

Tidy-Mat Shelf Liner.

Sanitized Shelf Liner

Tidy-Mat Shelf Liner, manufactured by Gering Products, Inc., is the first polyethylene product to be Sanitized. Treatment with a bacteriostat inhibits germ growth and makes the liner antiseptic, thus increasing its protective qualities. Tidy-Mat is washable, odorless, and flexible. It will not fade or stain.

Readers' Service Item 45

Polystyrene Abacus

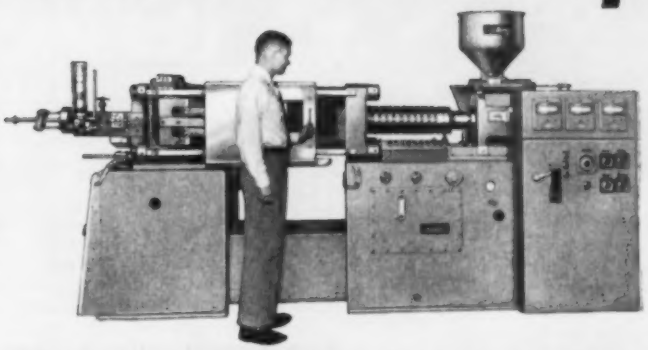
The Arithme-Stick, an instructional device for teaching elementary arithmetic, is being offered by Ginn & Co. Based on the idea of joining similar elements to represent our number system, the device consists of tongued-and-grooved sticks made of Dow Chemical Co.'s high-impact polystyrene, Styron 475, and polyethylene snap-on beads used as counters.

The sticks may be used singly to teach elementary concepts or combined for use as a computer, number board, or abacus. The device, which is molded by Morningstar Corp., is adjustable to provide for teacher demonstration, individual and

Produce Plastics Profitably!

Model H-400
4-6 oz. CAPACITY

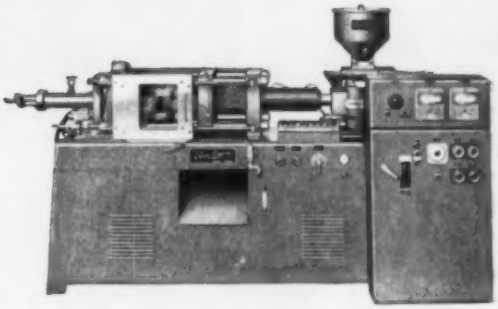
This automatic Van Dorn plasticizes 100 pounds plus per hour, has 175 tons clamping pressure, and achieves up to 840 dry cycles per hour. This press also features: Fast Mold Set Up, Four Tie Bars, Adjustable Toggle Stroke, and Maximum Operator Protection.



SELECT A VAN DORN PRESS

Model H-300 3 oz. CAPACITY

This automatic Van Dorn plasticizes 65 pounds plus per hour, has 75 tons clamping pressure, and achieves up to 1200 dry cycles per hour. This press also features: Fast Mold Set Up, Four Tie Bars, Adjustable Toggle Stroke, and Maximum Operator Protection.



BEST FOR YOUR NEEDS

Model H-260 2½ oz. CAPACITY

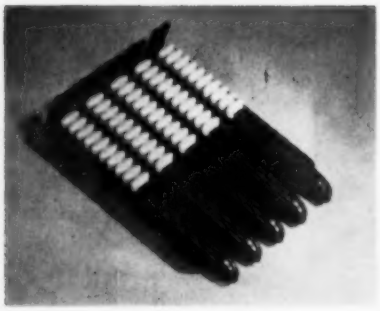
For greater efficiency, this automatic Van Dorn has a High Capacity Heater. The press plasticizes 30 lbs. plus per hour, has 30 tons clamping pressure, and achieves up to 720 dry cycles per hour. This press also features a Fast Mold Set Up.

Write for Detailed Information

The Van Dorn Line also includes 2 oz. and 1 oz. capacity presses, and scrap granulators.

THE VAN DORN IRON WORKS CO.
2685 East 79th Street • Cleveland 4, Ohio

Van Dorn
Established 1872



Ginn & Co.'s Arithme-Stick

small-group experimentation, and parallel teacher-pupil manipulations.

Readers' Service Item 46

Heat Sealing Mylar Tape

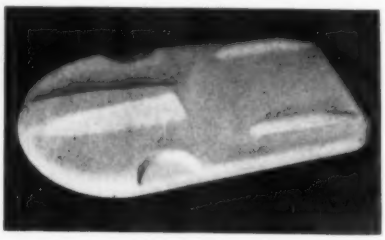
Peters coated-Mylar cable.

Rubber coated Mylar, developed by Peters Manufacturing Co., is reported to heat seal in the 200° F. temperature range. Key advantages of this waterproof tape are: thin gage (three mils), color stability, and compatibility (no plasticizer migration).

Readers' Service Item 47

Newly-designed Flutter Board

The Swim Fun Board, a new expanded polystyrene kick, flutter, and paddle board, has been announced by Aeroplastics Corp. The board, with hydroplane fins for stability and attractiveness, is unsinkable, light, tough, durable, weatherproof, and can support up to 200 pounds. It is available in bright yellow.



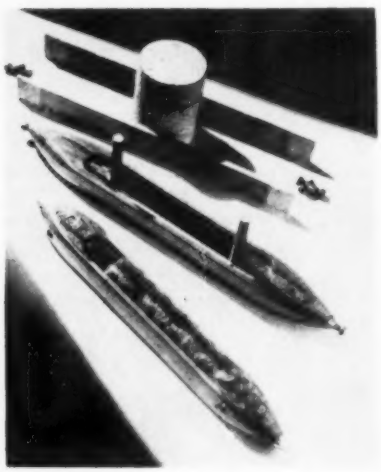
Polystyrene Swim Fun Board.

Readers' Service Item 48

Formica Laminated Shuttle

A resin-impregnated cotton laminate which can withstand the beating given a high-speed shuttle has been developed jointly by Formica Corp. and Draper Corp. Multiple strips of uni-directional cotton duck, saturated with resin, make up the sides of the shuttle. These are pre-molded into a frame, with a slot down the center for the bobbin. The pointed ends of the shuttle are formed later from resin-saturated macerated cotton duck, molded around steel tips which are machined to a point after the shuttle is completed.

The macerated material used in the ends of the shuttles is preformed into plugs on Stokes Model 294 presses. Final molding is carried out on a battery of eight Stokes 300-ton Model 727 semi-automatic transfer presses.



Stages in production of plastic shuttle.

Reader's Service Item 49

One-Piece Telephone

A one-piece telephone, molded of an impact and stain resistant thermoplastic, is being distributed in this country by North Electric Co. The Ericofon, manufactured by L. M. Ericsson Telephone Co., Stockholm, Sweden, weighs 15 ounces, is 9¼ inches high, and has a 4½ by 3⅞ inch base.

WHAT DOES
BETTER TEMPERATURE CONTROL
MEAN TO YOU?

It might mean greater accuracy . . . more consistent reliability . . . simplicity . . . elimination of vacuum tubes or possibly compactness or low cost. Another way, it could mean greater volume of production . . . improved quality . . . lower unit-costs. *Any* way, in many different fields, it means instruments by WEST.

Here and abroad we produce a wide selection of controllers, indicators and recorders for temperature and other variables, as well as complete systems and accessories. Our men in scores of cities offer qualified counsel. Write for Bulletin COM.

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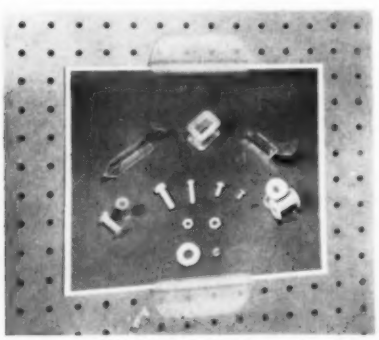
President Eisenhower & Ericofon.

The dial is located on the base of the instrument. It is operated merely by lifting it. The receiver is sealed in the upper part of the cast; the transmitter, in the lower front part of the base. The set comes in 18 colors.

Readers' Service Item 50

Nylon Pegboard Clip

Norton Laboratories Division of Auburn Plastics, Inc. has just introduced a pegboard clip, molded completely of nylon, which is designed for fastening photographic or display materials to pegboards. Made to fit the hole spacing in standard pegboards, each clip has a lip for holding the display material to the board.



Nylon Pegboard Clip.

Readers' Service Item 51

INSTRON

a new dimension in precision plastics testing

Viscoelastic Properties from Stress-Strain Data

Can viscoelastic properties of rubber-like materials be predicted from stress-strain data?

Here's how the problem was approached in a recent study. Stress-strain curves for polyisobutylene were developed on an Instron at several different strain rates and temperatures. Then, points on the curve were reduced mathematically to a single logarithmic stress-strain curve. Dynamic viscosity and stress relaxation modulus obtained from the data were compared with published experimental values.

The result? You can find it in Instron Bulletin PC-2, which describes this interesting study in full. It is one of many technical articles on advanced testing techniques from reliable, independent sources now available to you in reprint form. Just write

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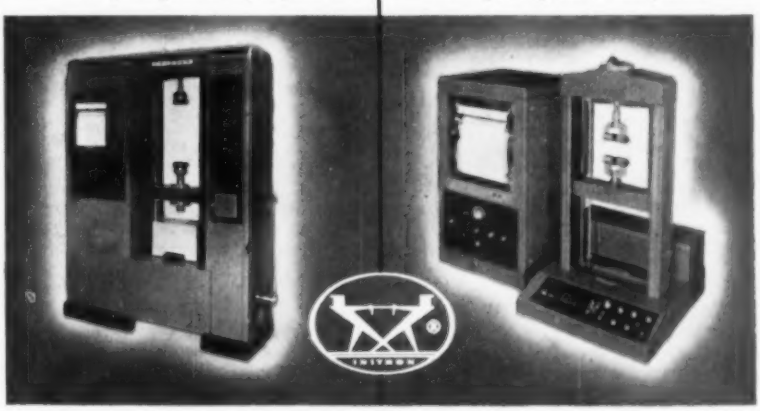
FLOOR MODEL INSTRON — *full scale load ranges: 2 grams to 10,000 pounds.*

TABLE MODEL INSTRON — *full scale load ranges: 2 grams to 200 pounds.*



New Literature

Write item numbers on Readers' Service Card (p. 85) to obtain more information.

"Plastisols and Organosols in Industry." The Stanley Chemical Co. 6 pages. This bulletin discusses the definition, compounding, and application of plastisols and organosols. The first in a series of data sheets on vinyls, lacquers, synthetics, enamels, and epoxies.

Readers' Service Item 61

"Alphalux Thermoplastics Selector Guides." Westlake Plastics Co. 6 pages. The characteristics, uses, and materials availability of six thermoplastics are given, with a table of physical and chemical properties. Materials described are Acrylux, Fluorolux, Styrolux, Hi-Styrolux, Ethylux, and Ultra-Ethylux.

Readers' Service Item 62

"Luminescent Pigment Color Selector." United States Radium Corp. 4 pages. Thirteen fluorescent and seven phosphorescent pigments are tabulated. Listed are: daylight color, fluorescent color, fluorescent brightness, specific gravity, approximate average particle size, chemical base, remarks, and uses.

Readers' Service Item 63

"Liquid Polyvinyls for Industry." Bee Chemical Co. 16 pages. Characteristics and possible applications of vinyl plastisols and organosols are given. Also included are methods of application and formulations.

Readers' Service Item 64

"Molds for the Plastic and Die Casting Industry." Liberty Tool & Machine Co. 4 pages. This illustrated brochure describes tools to make injection, compression, or transfer molds.

Readers' Service Item 65

"Typical Properties of Attapulgus Clay Products." Technical Information 1002. Minerals and Chemicals Corp. of America. 4 pages. This bulletin describes uses, chemical analysis, and physical properties of attapulgas clays. Also contains particle size distribution chart.

Readers' Service Item 66

"Using Silicones." Dow Corning Corp. 5 pages. A description of the uses, properties, and effects of Dow Corning Z-6020, an aminofunctional silane used as an additive to the resinous binder of glass fiber and mineral wool insulation products. The effects of Z-6020 on the properties of phenolic-glass laminates, epoxy-glass laminates, and melamine-glass laminates are tabulated.

Readers' Service Item 67

"Sssst—Just Like That You've Ended Damage to the Finish of Your Product." Spraylat Corp. 8 pages. This leaflet stresses the use of strippable coatings in protecting the finishes of metals, plastics, glass, rubber, ceramics, and painted or enamelled surfaces against weathering and abrasion.

Readers' Service Item 68

"Vapometer Water Vapor Permeability Cups." Thwing-Albert Instrument Co. 4 pages. This leaflet discusses water vapor permeability testing and the application of mechanical seal cups and wax seal test dishes for such testing. Diagrams with measurements of wax seals, gaskets, cups and casting templates.

Readers' Service Item 69

"Plax Plastic Containers and Accessories." Plax Corp. 34 pages. Tables and illustrations provide the specifications of plastic containers and accessories. Stock containers and available molds are included. Other information includes suggested use for each container, and printable area.

Readers' Service Item 70

"Nylatron GS Nylon Stock Shapes." Polymer Corp. of America. 4 pages. Property advantages of the material are given for such applications as gears, rollers, bearings, washers, wear strips, and pads.

Readers' Service Item 71

"Industrial Floors—How To Clean and Care for Them." Oakite Products, Inc. 10 pages. The following types of flooring are listed along with Oakite products recommended for cleaning them: concrete, wood, linoleum, asphalt tile, terrazzo, cork, rubber, vinyl, marble, masonite, ceramic tile, and metal.

Readers' Service Item 72

"Laminated Plastic Vulcanized Fibre." Data Sheet No. 2-0. Taylor Fibre Co. 4 pages. Six standard grades and five special grades of vulcanized fibers are described in this bulletin.

Readers' Service Item 73

"Your Bomb-Lube Handbook." Price-Driscoll Corp. 22 pages. Applications for the material are listed under compression molding, resin potting and casting, die and vacuum forming, plastics shearing and cutting, plastics machining, cold molded plastics, heat sealing, shell molding, and welding.

Readers' Service Item 74

"Urethane Foam Products and Uses in the Home." Mobay Chemical Co. 5 pages. Described are such applications as foam cushioning, rug and carpet underlay, sound and heat insulation, and thermal insulation.

Readers' Service Item 75

"Cut Costs with Epolite Formulated Resins." Rezolin, Inc. 6 pages. This illustrated flyer describes how costs can be cut in the foundry and pattern shop.

Readers' Service Item 76

"The Minds, Machines, and Manufacturing Skill of the Rex Corp. Rex Corp. 12 pages. To celebrate 25 years in business, the firm brought out this booklet which describes all four divisions of the company: aircraft and electronics, Rexolite cast plastic insulation, Rextrude plastic extrusions, and telephone and control cable.

Readers' Service Item 77

"Thermo-Cable Multi-Conductor Thermocouple Extension Cable." Thermo Electric Co., Inc. 4 pages. Thermo-Cable is a new type of polyvinyl-insulated multi-conductor cable for installing 6-56 pairs of thermocouple loads at one time.

Readers' Service Item 78

Book Reviews

"Insulation Engineering Fundamentals." G. L. Moses with two contributors. Lake Publishing Corp., 718 Western Ave., Lake Forest, Ill. 8½ by 11¼ inches, 124 pages. Price: $2.75 paperbound; $6.00 clothbound.

This book is based on a series of articles that appeared in "Insulation" magazine during 1956-58. Chapter headings include basic insulation concepts; insulation breakdown; general considerations for insulation selection; basic insulating materials; varnishes and resins; insulating compounds, plastics, and solvents; selection and application of insulating materials; electronic power-frequency insulation; special electronic insulation; construction of coils and windings for electric machinery; basic for insulation dielectric strength requirements and application methods; insulation for special parts of electrical equipment; effect of design on insulation and winding practices; use of insulating varnishes; shipment, storage, and tropical service insulation problems; statistical aids to insulation evaluation and manufacturing control; cleaning, drying, and renovating insulation and windings on electric equipment; insulation operating problems encountered on equipment; testing new equipment and materials; maintenance testing of electric equipment; and glossary of insulation terms and phrases. An index is also included.

"Proceedings of the National Electronics Conference: V. 13: 1957." Edited by M. H. Crothers, et. al. National Electronics Conference, Inc., 84 E. Randolph St., Chicago 1, Ill. Cloth, 6 by 9¼ inches, 1,066 pages. Price, $7.50.

The volume contains 100 papers presented at the National Electronics Conference held October 7-9, 1957 at Hotel Sherman, Chicago. The following subjects are included: general, transistor, circuits, communications, servomechanism applications, audio, semiconductor devices, microwaves, circuits, radio astronomy, transistors and transistor applications components, servomechanism theory, solid state, computers, radar and radio navigation, instrumentation, electron tubes, circuit theory, magnetic amplifiers and network synthesis.

Two papers of special plastics interest are No. 1012, "Piezoelectric Ceramic Reed Filters," by J. H. Denny and C. A. Rosen; and No. 1044, "An Investigation of the Effects of Humidity and Temperature on XXX-P Printed Wiring Boards," by J. Spalding. The first describes the preparation of ceramic reed filters; Krylon, an acrylic spray made by Krylon, Inc., is the coating agent used before electroding, and Hysol, a heat curing epoxy adhesive supplied by Houghton Laboratories, bonds the two parts of the reed. The second reports an investigation based on measurements of resistance between printed wires under varying conditions, to determine the effects of humidity on printed circuit boards.

Many schematic diagrams, figures, and tables illustrate the volume.

"Report on Visit of U.S.A. Plastics Industry Exchange Delegation to U.S.S.R." Published by the Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y. Paper, 7¼ by 10½ inches, 61 pages. Price, $2.00 plus postage.

This report was prepared by the members of the U.S. Plastics Delegation which visited the Soviet Union from June 2-28, 1958, and represents the joint efforts of the eight-man team (W. T. Cruse, of SPI; C. W. Blount, of Union Carbide; C. R. Mahaney, of St. Regis Paper Co.; R. E. Burk, of DuPont; J. E. Fitzgerald, of Brunswick-Balke-Collender Co.; J. T. Kinsella, of Allied Chemical Corp.; V. V. Lindgren, of American Cyanamid Co.; and Theodore Shevzov, of Naugatuck Chemical Division of U. S. Rubber Co.) The report covers such topics as trade in the U.S.S.R.; plastics exhibit, U.S.S.R.; plastics factories visited; research in the U.S.S.R.; research institutes visited; and chemicals in Russia.

"The Atom and the Energy Revolution." Norman Landsdell. Philosophical Library, Inc., 15 E. 40th St., N. Y. 16, N. Y. Cloth, 6¼ by 9½ inches, 197 pages. Price, $6.00

Intended for the general reader who wishes to grasp the social and political implications of the current revolution in methods of energy production, and for the specialist in any related field of inquiry, this book discusses the development of atomic power in relation to trade, industry, and national sovereignty.

The book's scope is limited to peaceful uses of the atom, and includes such topics as: energy resources and demand; material sources of energy; releasing, developing, and exploiting atomic energy; and world-wide implications of atomic energy and its risks.

Thirty-two plates illustrate the text. A glossary of nuclear terms is appended.

"A Method of Determining the Epoxy Content of Cured and Uncured Resins." H. C. Anderson, U.S. Naval Ordnance Laboratory. Order PB 151150 from OTS, U.S. Department of Commerce, Washington 25, D.C. Paper, 20 pages. Price, 50¢.

Modifications of a chemical method used to determine the epoxy content of cured resins were made to study the mechanisms of cure for epoxy resins with amines. Silver nitrate solution and a potentiometric method were substituted for sodium hydroxide solution and a colorimetric method, respectively, in titrating the unused hydrochloric acid of the analytical reagent. Accuracy was verified by the close agreement between experimental results and literature of theoretical values for pure epoxy resins.

Results of the chemical method with the cured materials were corroborated by an infra-red technique. No effect was produced by grinding in a vibratory ball mill. Tests also showed that denatured alcohol could be substituted for absolute alcohol for separating the fine, electrostatically-charged powder from the steel balls without any apparent effect on the epoxy determinations.

"Effect of Surface on the Behaviour of Metals." Philosophical Library, 15 E. 40th St., N. Y. 16, N. Y. Cloth, 5½ by 9 inches 100 pages. Price, $10.00.

A collection of lectures on the role of surface in influencing the behavior of metals delivered at annual Institution of Metallurgists refresher course, 1957, the book contains the following papers: "Methods of Preparation and Examination of (metallic) Surfaces," G. L. J. Bailey; "Influence of Surface Treatments on the Chemical Behaviour of Metals," T. P. Hoar; "Relationship Between Surface Condition, Friction and Wear," F. T. Barwell; and "Influence of Surface on the Physical Properties of Metals," R. W. B. Stephens.

There is a bibliography for each paper.

"Synthesis of High-Impact Strength Adhesives from Epoxy Resins." S. Stivala and A. Resnick, Picatinny Arsenal, U.S. Army Ordnance Corps. Order PB 151128 from OTS, U.S. Department of Commerce, Washington 25, D.C. Paper, 11 pages. Price, 50¢.

This paper shows that reactive epoxy resins with promising adhesive properties can be synthesized from dihydroxydiphenyl sulfone and epichlorhydrin. Purpose was to obtain liquid epoxy adhesives which will cure at room temperatures and resist impact between —65 and 160° F.

Epoxy resins were synthesized from the 2,4 isomer, the 4,4' isomer, and mixtures of both isomers of dihydroxydiphenyl sulfone with the epichlorhydrin in the presence of sodium hydroxide. Resultant resins were low-melting solids, reactive with organic aliphatic polyamines, m-phenylene diamine, and phthalic anhydride; but non-reactive with the amine salt of a fatty acid (DMP-30 and ethyl hexanoic acid).

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Abstracts of Important Articles

Materials

"The Effect of Heat on the Mechanical Properties of Certain Glass Fabric Filled Laminates," W. J. Read, *Brit. Plastics*, 31, 10, 432 (Oct. 1958).

The resistance of glass fiber-reinforced laminates to continuous exposure to heat was assessed by means of flexural strength tests. Preliminary experimental work involved investigation into the effect of the type of pre-treatment of fabric, and the effect of direction of stress application. Heat resistances then were compared for laminates produced from 12 resins and resin mixtures, including phenolic, polyester, silicone, melamine and epoxy resins. As a result of the work, maximum continuous operation temperatures could be recommended, as follows: phenolic, polyester and epoxide resins—150-200° C.; melamine resins, about 200° C.; and silicone resins, 250-300° C.

"Changes in the Disperse State of PVC particles in Plasticizers," A. Kratochvil and J. Spirit, *Plaste u. Kautschuk*, 5, 3, 93 (March 1958).

The suitability of PVC pastes for dipping, spreading or pouring cannot be fully assessed from viscosity values alone, hence the refractometric method was employed to follow changes in the disperse state of PVC particles in plasticizer in relation to time and temperature. Results of the studies are reported as a contribution to the question of the stability of PVC-plasticizer systems. (In German.)

"Creep of Plastics and Its Importance in Practical Applications," I. Ronzoni, *Materie Plastiche*, 24, 2, 114 (Feb. 1958).

The author reviews the creep phenomena of plastics, the methods of studying and determining them, as well as their effects on the behavior of products. He explains how this knowledge may be utilized in practice. There are 58 references. (In Italian.)

"Vacuumforming of Mixtures of PVC and Vinyl Acetate Copolymers," H. Luttropp, *Plaste u. Kautschuk*, 5, 3, 87 (March 1958).

The properties that make thermoplastics suitable for vacuum-forming are mentioned, with special reference to copolymers of PVC and vinyl acetate. Tests indicated that blends of 80 parts vinyl-acetate copolymer and 20 parts PVC have excellent deep-drawing characteristics. These properties decline as the proportion of PVC is increased. Under certain conditions, however, PVC lends itself to vacuum-forming for various purposes. The influence of the thickness of the sheet and of a certain stabilizer on the molding properties of PVC and mechanical values of vacuum-molded mixtures of PVC and vinyl acetate copolymers, and also of polystyrene, are shown in tables. (In German.)

"Wear Trials on Resin-Rubber Soles," D. L. Clarkson, *Rubber & Plastics Age*, 39, 9, 751 (Sept. 1958).

Soles of natural and synthetic rubbers with high styrene resin, PVC soles, and leather soles were tested for durability and spread. Results of the tests led to a formulation using Butaker S7001 and natural rubber, which showed the highest durability and no appreciable spread in tests over a 12-month period.

"The Importance of Aqueous Dispersions for Manufacturers and Consumers of Varnishes and Paints," M. Biele and R. Facius, *Plaste u. Kautschuk*, 5, 3, 121; 5, 4, 165; 5, 5, 205 (March, April, & May 1958).

Types of plastics dispersions, their film-forming properties, methods of testing dispersions, and compounding ingredients, are described in the first part of this article. Manufacture and coloring of latices, quality control, packing, and storage are covered in part II. Finally, application and prospects for further development of dispersion-based paints and varnishes are dealt with. (In German.)

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in October. The last listing appeared in the June issue.

"Thermal Aging of Bisphenol-Epoxy Resins," P. Nowak and E. Steinbacher, *Kunststoffe*, 48, 12, 558 (Dec. 1958).

Unfilled castings of a bisphenol/epoxy resin with epoxide equivalent of 400, cured with varying amounts of phthalic anhydride, were aged for up to 29 weeks at various temperatures, and changes in their mechanical properties were determined by measuring free-torsion oscillations in relation to temperature, followed by shrinkage measurements. The marked influence of the proportion of hardener in relation to temperature could be shown. (In German.)

"Effects of Irradiation on Polysiloxanes," K. H. Krause, *Kunststoffe*, 48, 12, 564 (Dec. 1958).

Report on irradiation tests on polysiloxanes carried out by Midland Silicones, Ltd., in England. (In German.)

"Organic Pigments for PVC," G. M. Reiner, *Materie Plastiche*, 24, 3, 239 (March 1958).

The influence of various factors on the coloring of PVC is discussed, such as thermal stability, purity of the colorant as well as the stabilizers, plasticizers, and processing methods employed in its production. Various organic and inorganic pigments are examined and compared, and methods of identifying colors, testing light stability, and the effects of color concentrations are described. (In Italian.)

"Expanding Agents," E. Ferraris, *Materie Plastiche*, 24, 3, 260 (March 1958).

The chemical composition, properties, and action are outlined of a number of organic and inorganic products used to produce expanded rubber and plastics. American and other patents are mentioned. (In Italian.)

"Contribution to the Analytical Chemistry of Plasics. VIII. Supplements to and Improvements in the Analysis of Polyamides," E. Schroder, *Plaste u. Kautschuk*, 5, 2, 49 & 5, 3, 103 Feb. & March 1958).

Quantitative analysis of polyamides requires preliminary testing to determine the nature of the components. The different preliminary tests are discussed, including paper chromatography, and critical salt and sulfuric acid concentrations.

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Abstracts of Important Articles (Cont'd.)

Quantitative analysis of unary and binary mixed polyamides is simplified considerably by the use of basic and acid synthetic resin ion-exchangers. A method generally applicable to binary polyamides was developed involving ion-exchange chromatography. Amino terminal groups were determined in polyamide injection molding compounds by the method described by Rathgeber and Zahn for polyamide fibers, the propargyl alcohol being replaced by o-cresol. (In German.)

"Determination of Hydroxyl Groups in Epoxide Resins," A. Bring and Fr. Kadlecek, *Plaste u. Kautschuk,* 5, 2, 43 (Feb. 1958).

At present, the literature offers only one reliable method for determining the content of hydroxyl groups in epoxy resins: the action of lithium aluminum anhydride on the resin. Since the method is difficult and requires apparatus and reagents not readily available, the authors developed a method that is a suitable modificatin of the stearyl chloride method of Raymond-Bouvetier, originally intended for determining hydroxyl groups in substances soluble in benzene or carbon tetrachloride. (In German.)

"High Alkali Fiber Glass Reinforcements for Polyester Boats," A. Wende and A. Bergemann, *Plaste u. Kautschuk,* 5, 2, 69 (Feb. 1958).

In the experimental production of glass-reinforced polyester resin boats, woven fiber glass was used having the highest alkali content (17%) and softened with a mineral oil dressing. In practical tests, complete loss of mechanical strength occurred within a maximum of two years. Similar tests are in progress in which the same kind of alkali glass fiber is used, but is Silanized instead of being treated with mineral oil. (In German.)

"The Higher Vinyl Esters," P. L. Sbrolli and G. Leicht, *Materie Plastiche,* 24, 2, 147 (Feb. 1958).

Review of the preparation and characteristics of monomers, polymers and copolymers obtainable from the higher vinyl esters. Of 88 references listed, about half are patents. (In Italian.)

"The Production of Acrylic Resins from Methane," G. Golvan, *Poliplasti,* 6, 26, 50. (March-April, 1958).

Brief description of the production of acrylic resins by direct synthesis from methane and ammonia. (In Italian.)

"Plastics in Conveyor Belting, with Special Reference to the Mines," C. G. Addingley, *Trans. Plastics Inst.*, 26, 65, 227 (July 1958).

Because of its non-flammability, PVC and textile conveyor belting has now replaced piled rubber belting as standard equipment in British coal mines. The PVC belting is of two main types: the solid woven type in which several plies of fabric are bound together in the weaving process, then impregnated and coated with plasticized PVC; and the type built like plied rubber belts. The development of PVC belting is described, with special reference to test methods, and test results on the solid woven-type belting are compared with those on rubber belting.

"Development of the Chemistry of Epoxy Resins," A. M. Paquin, *Kunststoff-Rundschau*, 5, 4, 147; 5, 5, 191; 5, 6, 234; 5, 7, 287. (April, May, June & July 1958).

The author follows the development of epoxy resins from the earliest, neglected findings, in Germany in 1934, and reviews the various means and methods of modification evolved up to 1956. There are 389 references, patents, for the most part. (In German.)

"The Flow Properties of Polyethylene and their Effect on Fabrication," P. L. Clegg, *Trans. Plastics Inst.*, 26, 64, 151 (April 1958).

The Melt-Flow Index gives no detailed knowledge of the flow properties of a polyethylene melt; but satisfactory characterization is possible over a wide range of pressures and out-put rates by means of a small, gas-operated, laboratory extrusion machine. This apparatus shows up two defects of the extrudate as out-put rate is increased; surface roughness (mattness), and waviness. The former depends on the flow in the die parallel to the material path, while the latter depends on the flow condition in the die-entry region. Examples of similar defects observed under commercial processing conditions are described. It is suggested that a more complete understanding of flow in polyethylene eventually may permit prediction of a given polymer's behavior under any given set of fabrication conditions.

"Determination of Tracking Resistance by the Drop Method with Limiting Number of Drops or Limiting Stress," W. Clausnitzer and V. Siegel, *Kunststoffe*, 48, 7, 299 (July 1958).

According to German specifications VDE 0303 and DIN 53,480, tracking resistance of insulation material is tested by dripping an electrolyte of definite composition between two electrodes at 380 volts, the measure of resistance being the number of drops required to produce a short circuit. It has been suggested that determination of a minimal limiting voltage below which tracking no longer takes place, rather than the number of drops at fixed voltage, should be the criterion. Both methods, therefore, were investigated. Results tend to favor the method using the limiting drop-number; however, it is pointed out that the problem still requires a satisfactory solution (above all, the influence of boundary surface phenomena, which are connected with surface and boundary surface tension, should be studied exhaustively. (In German.)

Equipment

"Money-Saving Single-Cavity Molds," W. Minsk, *Plastverarbeiter*, 9, 3, 87 (March 1958).

The economical advantages are considered for automatic injection-molding processes for thermoplastics in which single-cavity molds are employed. (In German.)

"The Market for Reinforced Plastics and Its Development," J. Schick, *Ind. Plastiques Mod.*, 11, 1, 5 (Jan. 1959).

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reinforced polyester resins during 1957 are compared with those in other countries, particularly the United States and Britain. France had the highest per-capita consumption in Europe, but corrugated and plain sheet for buildings accounted for 70% of all applications of the material, as against 15% in the United States and 28% in Britain. Obviously, there is ample room for future expansion in the use of reinforced polyester resins in France. (In French.)

"The Practical Value of Measurements on Plastics," F. M. Jacobs, *Plastics, (London)* 11, 5, 332 (May 1958).

The practical value of the large amount of testing that is done in laboratories to determine chemical, physical, mechanical, and other properties of plastics is examined, as well as the need for standardization methods. (In Dutch.)

"How to Use Mechanical Fasteners with Reinforced Plastics," M. D. Weiss, *Materials Design Eng.*, 49, 6, 84 (June 1959).

How to select and design fasteners (bolts, screws, inserts, and rivets) for use with glass-reinforced plastics.

"Beryllium Copper Pressure Hobbings," J. F. Schneider, *Western Plastics*, 6, 6, 23 (June 1959).

A brief review of the advantages provided by beryllium copper hobbings.

Processing

"Transfer Molding of Dough Compounds," J. D. Davies, *Brit. Plastics*, 31, 12, 509 (Dec. 1958).

Initial work on the factors involved in transfer molding of glass-filled polyester dough compounds includes position and size of gate, and the presence of inserts. Investigations on the effect of transfer temperature and pressure, and optimum fiber length and dough composition are in progress.

"Problems Related to the Thermoforming of Toughened Polystyrene Sheet," E. L. Williams, *Brit. Plastics*, 31, 12, 518 (Dec. 1958).

A general description of simple vacuum- and drape-forming, blister blowing, and plug forming of toughened polystyrene sheet is followed by a discussion of practical aspects of processing this type of sheet, chiefly for refrigerator liners. Suggestions regarding post-forming operations and the forming of pre-printed sheet also are given.

"High-Frequency Welding of PVC/Meta Laminates," G. Wielinga, *Plastica*, 11, 6, 435 (June 1958).

Under the high heat developed in the process of automatic high-frequency welding of Skinplate (PVC/metal laminate) to produce leak-proof drums and other containers, the thin, protective plastic layer is burned away, leaving an exposed area along both sides of the joint. The author describes three methods, patented by a Dutch firm, to remedy or avoid this condition. (In Dutch.)

"Electroplating Plastics Moldings," R. Uebigau, *Kunststoffe*, 49, 1, 45 (Jan. 1959).

Phenolic molding compounds are rendered conductive and suitable for electroplating by the incorporation of non-metallic, electrically-conductive fillers (e.g., carbon black or graphite). Such compounds can be processed like the usual phenol resin compounds, transfer-molding being the preferred method. The plastics moldings are electroplated in the same way and with the same baths as are the metal objects. (In German.)

Applications

"The Temperature Dependence of Electrical Resistivity of Laminated Thermoset Materials," T. D. Schlabach, *ASTM Bull.* No. 238, 33 (May 1959).

Results are given of tests on 12 different laminates over a 40-180° C. temperature range.

"Proved Injection Molding Compounds for Toys. Hard-Wearing Cellior A and B —Durethan BK for Special Applications," H. Kalpers, *Plastverarbeiter*, 9, 2, 43 (Feb. 1958).

Cellulose acetate and butyrate (Cellior A and B), polyamides (Durethan BK) and low-pressure polyethylene (Hostalen) increasingly are used in making a variety of attractive toys that can stand hard handling. The properties that make them suitable for these purposes are described, and hints on their applications are given. (In German.)

"New Developments in Adhesives for Plastics," Bernard Gould, *Plastics Industry*, 17, 4, 22 (April 1959).

A review of some new developments in adhesives.

General

"Brussels Built with Plastics—Constructional and Architectural Elements at the 1958 World's Fair," A. Schwabe, *Kunststoffe*, 48, 7, 327 (July 1958).

Description of the conspicuous plastics elements entering into the construction of 17 different halls and structures seen at the 1958 Brussels Fair. (In German.)

"The Future of Glass-reinforced Plastics," J. H. Collins, *Plastics (London)*, 23, 248, 161 (May 1958).

The author reviews failures and successes in the glass-reinforced plastics branch, and considers recent trends. The replacement of the wet lay-up method of matched-metal molding points to the use of cheaper condensation-type resins for many purposes. He foresees more conventional processing methods in the future leading to greatly increased consumption of new reinforcing fibers and new resins. The greatest development is likely to be in matched-metal moldings using dough-molded compounds and pre-impregnated long-fiber reinforcements.

"Plastics and Plastics Machinery at the Hannover Fair, 1958," J. Hausen, *Kunststoffe*, 48, 7, 306 (July 1958).

Comprehensive review of the plastics and plastics machinery shown at the Hannover Fair, 1958. Included are raw materials, semi-finished products, foamed materials, and adjuvants, as well as applications in the building, automobile, electric, packaging and other industries, in addition to all kinds of machinery for processing plastics. (In German.)

"Plastics at Mid-1958—an Outline of Developments in Techniques and Application," K. Mienes, *Kunststoffe*, 48, 7, 289 (July 1958).

Following up a similar review at the end of 1956, the author now highlights the chief advances made to the middle of 1958 in each of the main plastics. He notes the bias against thermoset resins, and stresses the need for increased technological and scientific education in Germany if she is to maintain her position in the international plastics industry. (In German.)

"Plastisol Foams," W. A. Riese, *Kunststoffe*, 48, 12, 596 (Dec. 1958).

Some formulations are presented for producing open- and closed-cell foams from plastisols. (In German.)

Patent Digest

Materials

Stabilization of Polymerizable Materials. No. 2,863,851. J. L. O'Brien, Philadelphia, Pa. (to Rohm & Haas Co., Philadelphia, Pa.)

A composition comprising a polymerizable ester of acrylic acid and, as a stabilizer therefor, from 0.005 to about 1%, based on the weight of said ester, of the compound, N,N'-di-2-(1,4-naphthoquinonyl)-p-phenylenediamine.

Melamine Purification Process. No. 2,863,869. Curtis Elmer, Springfield, and C. R. Stanley, Boston, Mass. (to Monsanto Chemical Co., St. Louis, Mo.)

In a recycle recrystallization process for the purification of crude melamine in which the latter is dissolved in water at an elevated temperature, the heated aqueous melamine solution is filtered, the filtered solution is cooled to precipitate purified melamine therefrom, and the filtrate is recycled and employed as the solvent for the dissolution of additional crude melamine; the improvement consists of heating the aqueous solution of crude melamine to a temperature of 265-285° F. under a pressure of 2-3 atmospheres, adjusting the pH of the aqueous crude melamine solution to 11.5-11.9 with an alkali taken from the group consisting of sodium hydroxide, potassium hydroxide, and calcium hydroxide, adding a diatomaceous earth filter aid to the heated solution and immediately thereafter passing the crude solution through a pressure filter without a substantial loss of temperature or pressure, delivering the filtered solution to a cool, open vessel to crystalize the melamine, and separating the purified melamine crystals from the filtrate.

Reducing Acidity of Polyesters by Treatment with Alkylene Carbonate. No. 2,863,854. C. L. Wilson, Sloatsburg, N. Y. (to Hudson Foam Plastics Corp.)

A method which comprises reacting a polyester having a molecular weight of at least approximately 1,000 and an acid number greater than about 16 and less than about 49.5. Said polyester is predominantly the product of esterification reaction between an organic dicarboxylic acid selected from the group consisting of adipic, azelaic, fumaric, succinic, pthalic, and terephthalic acids and a glycol selected from the group consisting of ethylene glycol and dipropulene glycol, with an alkylene carbonate in an amount ranging from about 100-268% of the theoretical sthoichiometric amount for completely reacting with the carboxylic groups of said polyester and at a temperature from approximately 200-250° C., thereby effecting esterification of the carboxyl groups with formation of hydroxyalkyl ester groups, and continuing said reaction until the acid number of the polyester is reduced substantially below 16, said reaction being discontinued while limited substantially to said esterification.

Epoxy Resin Compositions. No. 2,863,853. F. E. Pschorr, Phoenixville, Pa. (to Ciba Co. Inc., New York, N. Y.)

A composition of matter comprising a liquid polyglycidyl ether of 4,4'-dihydroxydiphenyldimethyl methane, methyl-endomethylene - tetrahydrophthalic anhydride, and 2,4,6-tri(dimethylaminomethyl) phenol wherein the ratio of the three components is about 100:70-90:1-3 parts by weight. Said composition when subjected to heat at an elevated temperature forming an insoluble and infusible resin having a high heat distortion temperature.

Method of Making Polyester Composition. No. 2,863,855. C. L. Wilson, Cranberry Lake, N. Y., and C. J. Benning, Mahwah, N. J. (to Hudson Foam Plastics Corp., Yonkers, N. Y.)

A method which comprises reacting a liquid polyester having a molecular weight of at least 1,000 and an acid number substantially above 10 and not substantially above 100, said polyester being predominantly the product of esterification reaction between an organic dicarboxylic acid and a glycol, with an alkylene oxide selected from the group consisting of ethylene, propylene, butylene, cyclohexene, styrene and hydroxy methylethylene oxides in an amount ranging from about 80% to about 230% of the theoretical sthoichiometric amount for completely reacting with the carboxyl groups of said polyester and at a temperature between 50-275° C., thereby effecting esterification of the carboxyl groups with formation of hydroxyalkyl ester groups and continuing said reaction until the acid number of the polyester is reduced substantially below 10, the said reaction being discontinued while limited substantially to said esterification.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.
—The Editor

Interpolymers of Styrene with Elastomeric Tripolymers and Method of Preparation. No. 2,861,974. John L. Lang, Midland, Mich. (to Dow Chemical Chemical Co., Midland, Mich.).

Graft copolymers with high elongation characteristics are prepared from styrene which has been interpolymerized with an elastomeric tenary copolymer of a monfunctional, monovinyl aromatic substance selected from the following group of substances: styrene, alkyl substituted styrenes, vinyl naphthalene, aliphatic conjugated diolefines, and vinylidene halide.

Modified Alkyd Resins. No. 2,862,898. Earl C. Chapin, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A glyceride drying oil-modified alkyd resin is further modified by reaction with ethylenically-unsaturated monomeric components at 180-250° C., in a solution of an inert organic solvent. The monomeric components consist of styrene alpha methyl styrene, ortho methyl styrene, meta methyl styrene, para methyl styrene, ortho para dimethyl styrene, and alpha para dimethyl styrene, plus a nitrile. The reaction is carried out under pressure of 10-50 atmospheres for a period of 15-60 minutes.

Process of Purifying Terephthalic Acid. No. 2,862,963. Otto Fuchs, Hofheim, and Helmut Jokusch, Bad Soden, Germany. (to Farbwerke Hoechst Aktiengesellschaft vormals Meister Lucius & Bruning, Frankfurt am Main Hochst, Germany).

Terephthalic acid is separated from a mixture of terephthalic and toluic acids by suspending the mixture in a substantially anhydrous liquid medium composed of an alcohol containing up to four carbon atoms and three hydroxyl groups, saturating the suspension with ammonia at a temperature of about 130° C., and separating undissolved ammonium terephthalate from the saturated suspension.

Production of Mixed Esters of Phthalic Acid. No. 2,862,959. Tracy M. Patrick, Jr., Kirkwood, and Louis O. Raether, Webster Groves, Mo. (to Monsanto Chemical Co., St. Louis, Mo.).

Phthalic anhydride is heated with a stoichiometric quantity of alkyl or cycloalkyl hydroxide; then, the remaining porton with a slight excess of a higher alkyl or cycloalkyl hydroxide. An acid esterification catalyst is employed.

Patent Digest (Cont'd.)

Process for Preparing Alpha-Chloroacrylic Compounds. No. 2,862,960. Maxwell A. Pollack, Morris Plains, N. J.

An alpha-beta dichloropropiono compound and a sulfonic acid are heated at a temperature of 50-300° C., until approximately one moleucle of HCl is removed This gives the alpha-monochlor-2,3 unsaturated compound.

Suspension Process for the Polymerization of Vinylidene Aromatic Hydrocarbons. No. 2,862,906. Alvin Stein and Robert L. Walter, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

An aqueous dispersion of a vinylidene monomer, an interpolymer of an acidic monomer of acrylic acid and 2-ethyl-hexyl acrylate, and a bis(sulfoaryl) alkane are polymerized to a granular product.

Vinyl Halide Polymerization Process. No. 2,862,912. John B. Ott, Northhampton, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

An aqueous dispersion of vinyl halide is polymerized in the presence of an acidic monomer of acrylic acid as a dispersing agent.

Low Temperature Preparation of Alkyd Resins from Long Chain Fatty Acids. No. 2,861,047. John S. Heckles, Lancaster Township, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

A long-chained fatty acid is reacted with pentaerythritol at a temperature of 150-250° C.; the ratio being 1.3-2.2:4, respectively. This forms a diester. About 0.5-1.5 equivalents of isophthalic acid are dissolved in the diester, and the mix is heated to 200-260° C. The resultant alkyd contains about 0.3-2.5 equivalents of the original long-chain fatty acid.

Cross-Linked Copolymers of Acrylonitrile and Polyvinyl Alcohols and Method of Preparing Same. No. 2,861,051. John R. Caldwell, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.)

Acrylonitrile or a mixture of acrylonitrile and a monomer of the group consisting of isopropenyl acetate and acrylamide, 24.9-53.9% by weight, is mixed with the following: 44.9-74.6% of a preformed polymer of polyvinyl acetate, vinyl alcohol, and isopropenyl acetate; and 0.5-1.2% of a cross linking agent such as divinylbenzene, diallyl phthalate, triallyl cyanurate, allyl acrylate, or ethylene glycol diacrylate. Addition polymerization gives the graft copolymer.

Method of Preparing Interpolymers of a Vinyl Ester, a Conjugated Diene Hydrocarbon, and an Ethylenically-Unsaturated Monomer, and Product Thereof. No. 2,861,050. Robert M. Christenson. Milwaukee, Wis. (to Pittsburgh Plate Glass Co., Pittsburgh, Pa.).

About 20-50% by weight of a vinyl ester of a fatty acid containing eight carbon atoms is mixed with 10-40% of a conjugate diene, 20-40% of a compound having at least one terminal ethylenic group which is not in conjugate relationship with any aliphatic ethylenic group, and 0.1-10% of an inorganic peroxide catalyst. The solution is heated until a heat-curable interpolymer is formed. The resultant interpolymer is soluble in xylene and is non-rubbery.

Novel Coated Particulate Foamable Styrene Polymer Compositions. No. 2,861,898. Norbert Platzer, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A particulate, foamable styrene polymer is sequentially coated with a water solution of alkaline earth metal salts and aluminum salts, plus an aqueous solution of a silicate salt. Coatings should be sufficient to deposit particles 0.1-5 weight percent of the water-insoluble silicate compound.

Moldable Slurry Comprising Vinyl Butyrate and Polyethyl Methacrylate and Molding Obtained Therefrom. No. 2,861,973. Harry Wechsler, Fitchburg, Mass. (to Borden Co., New York, N.Y.).

The hardenable, moldable fluid mixture contains liquid vinyl butyrate monomer and powdered polyethyl methacrylate.

Equipment

Injection Molding Machines. No. 2,862,238. Albert Cuzzi, Milan, Italy.

The machine consists of a supporting frame including a plurality of tie rods; a stationary die plate supported on the frame; a movable assembly, including a power cylinder supported on the tie rods and having a closed end and an open end facing the stationary die plate; a power piston movably mounted in the power cylinder and projecting from the open end; a die plate attached to the power piston and movably supported on the tie rods (opposite the stationary die plate); hydraulic moving means secured to the frame; reciprocating means secured to the movable assembly; and a hydraulically-operated clamping means. The latter clamps the power cylinder in the advanced position so that pressure fluid causes further advances and the movable die plate is pressed against the stationary die plate.

Method for Extruding and Foaming Resin. No. 2,860,377. Ernest Carl Bernhardt and Harold Barnard Whitfield, Jr., Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

A gas is dissolved in the material while it is being advanced through an extruder barrel by the screw. The material foams on leaving the die through the release of the aforementioned gas. The screw has a zone of greater drag flow capacity following a throttling zone of lesser drag flow. It also has a hollow core communicating with the zone of greater drag flow in the forward half of a channel between threads. The gas is introduced into the plastic through this communication.

Method and Apparatus for the Manufacture of Phonograph Records. No. 2,862,233. Jack G. Brown, Los Angeles, Calif.

The apparatus consists of a pair of spaced pressure embossing means bearing record matrices, means for longitudinally folding a single sheet of at least double width thermoplastic material which is preprinted with two parallel rows of longitudinally-spaced printed impressions into two superimposed strips of equal width, a means for slitting the folded sheet along the fold line to form two separate superimposed strips, means for drawing these strips between the record matrices, means for intermittently actuating the pressure embossing means, and a time control means, and a time control means for deactivating the pressure.

Automatic Forming of Thermoplastic Materials to Optically True Contours. No. 2,861,297. Antone M. Guerreiro, Long Beach, Calif. (to Northrop Aircraft, Inc., Hawthorne, Calif.).

This device for forming materials into simple and compound curves comprises a base, mold, reciprocable means on and in frictional engagement with the material to urge it to the mold contour, guiding elements, and a structure for equalizing the force on the material.

Apparatus for Fabricating Hollow Bodies. No. 2,862,236. Wallace H. Shapero, Los Angeles, Calif. (to Wallace Containers Co., Los Angeles, Calif.).

This apparatus is for dip-forming flexible hollow articles. It includes a series of dipping mandrels, each having an outer surface shaped to impart an internal wall of the desired contour; a circular tank to hold the plastic material; a means for supporting the tank for rotation in a horizontal plane about its vertical axis; rotating means; an endless conveyor from which the mandrels are suspended; a track for supporting and guiding the conveyor; and a means for driving the conveyor.

Manufacture of Plastic Bottles and Similar Hollow Bodies. No. 2,861,295. Reinhold Hagen and Norbert Hagen, Siegburg, Germany.

The apparatus includes a sectional mold to form, when closed, a cavity for forming the bottle and an annular extrusion nozzle for extruding an open-ended tube to extend vertically between the open mold sections. The nozzle is formed by an outer and inner ring, arranged concentrically to each other. A portion of the blow pipe extends axially through the inner ring, and an end portion projects beyond the extrusion nozzle into the mold cavity. This portion has an external diameter substantially equal to the internal diameter of the bottle neck. The other portion defines an annular space, and the blow pipe itself forms a conduit for a gaseous pressure medium to be led into the article to be blown. The mold sections are provided with edges to pinch the tube shut at a point remote from the nozzle.

Apparatus for Molding Telephone Handset Handles. No. 2,860,376. William C. Graves and Fred H. Walti, Indianapolis, Ind. (to Western Electric Co., Inc., New York, N. Y.).

The molding apparatus comprises a platen with angularly-extending slots and guideways extending transversely of the slots; a pair of elongated, socket-forming cores at the end of the guideways for transverse sliding movement; a draw means connected to the cores and extending through the slots for transverse movement of the cores, while preventing longitudinal movement; a first mold section movably mounted on the platen and having angularly-disposed bores from which the cores extend; and a second mold section movably mounted on the first. This mold section has a mold cavity for receiving projecting portions of the cores, the platen and first mold section being movable apart to pull the socket-forming cores from an article molded therein.

Stuffing Mechanism for Injection Molding Press. No. 2,862,240. William Strauss, Philadelphia, Pa. (to F. J. Stokes Corp., Philadelphia, Pa.).

The mechanism comprises a stuffing chamber whose interior walls define a bore; a ram mounted in the bore in sliding engagement with the walls; a feed port through the walls and into the bore; means for reciprocating the ram past the feed port; proportional feed means connected to the port for delivering a charge of material into the bore when the ram is withdrawn (the amount is proportional to the length of the stroke); and a means for actuating the reciprocal means to withdraw and return the ram. The last actuating means is timed so that the ram can reach a predetermined position.

Injection Molding Processes and Apparatus Therefor. No. 2,862,239. Harold John Pollard and John Rees, Bristol, England (to Bristol Aircraft, Ltd., Bristol, England).

The apparatus is intended for injecting a liquid resin, catalyst, and accelerator into a mold. The resin is one which sets at room temperature in a commercially acceptable time. It comprises a mixing chamber; first and second conduit means for introducing the resin mixture; a non-return valve between first conduit and mixing chamber; non-return valve for second conduit means; a third conduit means which provides an injection passage by which the mixture may be passed from the mixing chamber into the mold; and a means for passing a cleaning solvent into the chamber through the injection passage.

Stripper Mechanism for Injection Molding. No. 2,860,374. James M. Harrison and Robert E. Smucker, Fort Worth, Tex. (To Crown Machine & Tool Co., Inc., Fort Worth, Tex.).

The molding device consists of a frame, a cavity platen, a core structure on the frame adapted to be inserted in the cavity (thus defining the molding cavity), a means for injecting the molten plastic into the cavity, a frustro-conical insertable core element, a stripper ring around the large end of the core element defining the top edge of the molded cup, a stripper rod in the center of the core element adapted to bear against the bottom of a molded cup, and a means for actuating the stripper rod and ring in timed relation to each other so that pressure will be brought against the edge of a molded cup by the stripper ring ahead of the stripper rod.

Melt Extractor Type Heating Cylinders. No. 2,860,375. Mario Maccaferri, Rye, N. Y.

Parts include a heat-conducting cylinder body with plastic intake opening, discharge opening, and an axial bore between the two; a melt extractor sleeve of heat conducting material with mounted-in axial bore; and a melt extractor core extending axially through the bore. The core member has an axial passage with ducts. The cylinder body and sleeve are so formed as to provide plastic melt-receiving channels longitudinally. The sleeve has ducts from and along the outer side of the annular passage to the channels. The cylinder has plastic-melt flow passages from the axial passage within the core member and from the channels around the sleeve member to the discharge opening.

Apparatus for the Automatic Controlled Feeding of Plastic Material. No. 2,862,241. Lawrence De Mattia, Cedar Grove, N.J. (to De Mattia Machine & Tool Co., Clifton, N. J.).

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The machine is designed to operate in repeated pressure cycles. Essentially, it consists of molds, nozzle opening, material-receiving bore, pressure means for forcing molten plastic through the nozzle and filling the molds, and a means for relieving the pressure and filling the bore with a new batch of material. This completes the pressure cycle of the machine. There is also a device for relieving pressures due to excess material in the bore (more than the amount required to fill the molds). This device consists of a chamber with an opening into the nozzle, a bore in line with the opening, and a movable means in the bore for closing the chamber end opening under a pressure greater than that normally exerted against the nozzle, but of less pressure than that set up by an excess of material. Thus, the chamber opens to receive the excess which is then returned to the bore of the machine for mingling with the next batch of material (the succeeding cycle).

Extrusion Head. No. 2,863,170. Philip W. Foss, Melrose, Mass. (to Rex Corp., West Acton, Mass.)

The apparatus extrudes plastic coating upon a wire. It consists of two concentric bores, the inner feeding the wire, and the outer, the extrusion. The design permits the passage of an electrical current through the shell of the inner bore.

Wire Cutting and Stripping Tool. No. 2,863,158. Kenneth T. Miller, Longmeadow, Mass.

A tool for cutting off the end of insulated wire and stripping insulation from an end portion of the wire, consisting of an upper pair of insulation severing plates and a lower pair of cut-off blades mounted on pivoting handles.

Extruding Dies. No. 2,863,169. Arthur G. Foster, Towson, Md. (to Western Electric Co., Inc., New York, N .Y.)

The plastic is extruded through an internal bore which intersects with a curved outer face and a flat surface at the exit end.

Processing

Process for Forming Granules of Thermoplastic Polymeric Materials. No. 2,862,243. John W. F. Farr, Luton, William S. Gilmour, Welwyn, and Alexander Kennaway, London, England (to Imperial Chemical Industries, Ltd., London, England).

The process is one for converting thermoplastic material into granules by extruding it in molten condition as threads or rods directly into a cooling liquid and cutting it into pellets. The improvement is said to lie in extruding the material through a plurality of die orifices lying in the same plane around an axis parallel to the direction of extrusion. Extrudate is cut transversely with a cutter which rotates about the axis. The cooling liquid is directed onto the cutter in a direction transverse to the axis of extrusion, thereby aiding the centrifugal action of the cutter in removing the pellets from the region of the orifices.

Extrusion Molding of Copolymers of Trifluorochloroethylene and Vinylidene Fluoride. No. 2,862,244. Lester E. Robb, Westfield, N. J. (to Minnesota Mining & Mfg. Co., St. Paul, Minn.).

The process involves shaping in an extruder an elastomeric copolymer of the two above-mentioned materials. Steps comprise heating them to a temperature of about 70-190° F., while moving them through a die land heated to the same temperature.

Filling Voids with Plastic Foam. No. 2,860,378. Demetrius Urchick, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

The technique involves filling structurally-confined voids with closed-cell plastic foam containing a gaseous residue of primary propellant. Expanded plastic foam is cooled from a normal temperature to a temperature sufficiently low as to cause contraction of the gas. This collapses the foam to a degree. The void is filled with this cooled foam which is allowed to warm to room temperature. It again expands to fill the void completely.

Method of Molding Thermosetting Synthetic Materials with Surface Decoration. No. 2,860,380. Harold Walker, New York, N. Y.

The interior of a pre-forming machine is heated and a pill is formed from the molding powder; the heated portion partially curing the pill's surface. The pill is removed and a design is applied to the partly cured portion of the pill's surface. Then, the pill is placed in a heated mold for complete cure.

Process of Making Vinyl Resin Plastic Sponge. No. 2,861,963. Paul V. Butsch, South Bend, Ind. (to United States Rubber Co., New York, N. Y.)

Plasticized vinyl sponge is made by mechanically frothing a plastisol consisting of 85-95% vinyl chloride monomer (the rest being other vinyl monomers), 50-400 parts of a high-boiling organic liquid plasticizer, 1-25 parts of a non-ionic surfactant, 3-100 parts of an alkali metal salt of a sulfonated fatty acid, and 1-25 parts of an alkali metal salt if ethylene diamine tetraacetic acid. The froth is heated at a temperature and for a time sufficient to fuse the resin particles while maintaining the froth structure.

Method of Casting Phenolic Resins in a Tin-Plated Mold. No. 2,860,947. Joseph F. Kalat, Chicago, Ill. (to Western Electric Co., Inc., New York, N. Y.).

Non-shrinking phenolic casting resins, hardened by an acid catalyst, are molded in an open steel mold which has been tin plated.

Process of Foaming a Mixture of a Thermoplastic Resin and a Binding Agent. No. 2,861,046. Fritz Stastny, Ludwigshafen, Germany. (to Badische-Anilin & Soda Fabrik, Ludwigshafen, Germany).

About 10-90 parts by weight of an expandable thermoplastic resin are mixed with 10-90 parts of a binding agent such as bitumen or a paraffin wax with a melting point below the softening point of the styrene or polymethacrylic acid methyl ester. The resultant mixture is heated to coat the resin particles with the binding agent; then heated further to soften and expand the resin.

Process of Bleaching Solid Gelled Acrylonitrile Polymers with Acidified Chlorite and Oxalic Acid Baths. No. 2,861,864. Allan O. Mogensen, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

Color is removed from a freshly extruded polymeric article which is produced by a wet process and contains normally-occurring discolorations. The material in question is an acrylonitrile (80% by weight) co-polymer. The article is immersed in two baths; one, an acidified aqueous solution of a chlorite; the other; a 0.2-2% aqueous solution of oxalic acid. Both baths are heated slightly, and a water rinse is given the articles when changing from the first to the second bath.

Formation by Irradiation of an Expanded, Cellular Polymeric Body. No. 2,862,862. Arthur Charlesby Headington, and Maurice Ross, London, England. (to United States Atomic Energy Commission).

A polymeric ester of a methacrylic acid having a softening point above 40° C., is subjected to a dose of at least 5×10^6 Roentgen of gamma radiation from a cobalt 60 source until its average molecular weight is reduced to a value within the range 3×10^5 to 10^4. It is then heated to a point about 10° above its softening point to effect expansion. The material will have a smooth skin.

Process for Clarifying Oriented Vinylidene Chloride Polymer Films. No. 2,863,173. Carl P. Zupic, Midland, Mich. (to Dow Chemical Co., Midland, Mich.)

Oriented thermoplastic polymer films of a normally crystalline vinylidene chloride polymer having an inherent haze due to the presence of voids surrounding discrete particles of an incompatible, inert, inorganic compound are subjected to a pressure of 300-800 psi. under tension at 30-100°C. to force the polymer into intimate engagement with the particles of incompatible compound.

Production of Preforms and Longitudinally Curved Articles of Polytetrafluoroethylene Resin. No. 2,863,174. Paul D. Schuman, Sayreville, and Edward J. Chu, Belleville, N. J. (to Resistoflex Corp., Roseland, N. J.)

Particles of polytetrafluoroethylene resin are admixed with an extrusion aid into a hollow cylindrical preform in two concentrations. The preform is forced in the axial direction through a circular forming die about a mandrel for producing a tubular cross-section so that the different concentrations are extruded at different rates, causing the extrude to curve as it leaves the die.

Process of Producing Mats of Glass Fibers. No. 2,863,176. Dominick Labino, Toledo, Ohio (to L. O. F. Glass Fibers Co., Toledo, Ohio).

The process of producing fibrous mats having substantially fuzz-free surfaces by: providing a gaseous flow stream of suspended siliceous fibers; introducing into the stream and into contact with the surfaces of the suspended fibers the vapors of an alkali metal halide, phosphate, or nitrate which fuses and vaporizes without decomposition; and collecting the coated fibers as a mat.

Art of Manufacturing Reinforced Plastic Articles. No. 2,863,797. Arnold F. Meyer, Pewaukee, Wis. (to Heil Co., Milwaukee, Wis.)

Steps in this method of applying a reinforced-fabric coating to an article which is to have a curved surface over a filled-in space are: laying resilient cured foam against the fabric in the mold cavity; filling the space between the article and the foam with wooden blocks shaped to conform with the curve of the mold; compressing the foam; and pouring a hardenable plastic into the mold to impregnate the fabric. The pressure exerted by the liquid plastic must not be greater than that of the foam.

Applications

Automatic Plastic Button Attachment. No. 2,863,197. Noel Statham, New Canaan, Conn.

A button comprising a body of deformable plastic material including a head with a neck which terminates in a flat face, and a flat-headed metallic fastener having a barbed shank driven through the neck into the head, and secured by a ratchet effect exerted by the barbs. The neck is formed with a diametrical cross-bore of larger diameter than the fastener shank, which serves to accommodate the burred plastic displaced by the driving in of the shank and permits a portion of the barbs to spring outward to an unstrained condition.

Molded Articles and Methods of Making Same. No. 2,863,241. Joseph A. Gits, River Forest, Ill.

A molded article consisting of a support of light-colored material and indicia of a darker material.

Method of Packaging Epoxy Resins. No. 2,862,616. Lawrence Capozzi, East Paterson, N. J., and Philip Kenner, New York City. (to Lancaster Chemical Corp., Carlstadt, N. J.).

The package includes a container, a layer of liquid epoxy resin, and a layer of curing agent. Layers are separated by an impermeable film produced by the interaction in situ of resin and curing agent.

Pouring Spout. No. 2,860,821. Richard E. Hartung, Rumsen, and Cleonard F. Harms, East Keansburg, N. J. (to Plastics Mfg., Inc., Orange, N. J.).

The pouring device comprises a tube secured at the lowered end, a spout cap having a serrated portion on the inner face of the end wall, means for moving the spout cap axially on the tube, and a laterally-extending lip.

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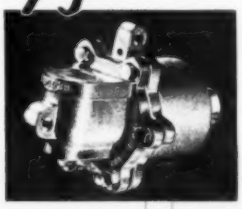

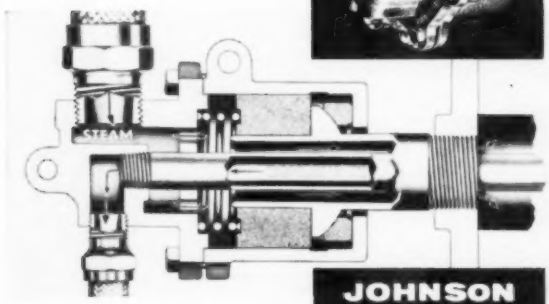

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Truflex Standard			
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DDA, DIOA, DOA	lb.	.40	.435
DDP	lb.	.26	.30
DIOP, DOP	lb.	.25	.29
ODP	lb.	.255	.295
Epoxy			
E-54	lb.	.3325	.3625
E-64	lb.	.33	.36
E-68	lb.	.3475	.3775
E-72, #-74	lb.	.3925	.4225
Specialty			
FP-8	lb.	.245	.285
FP-12, 310	lb.	.265	.305
320	lb.	.37	.41
Resins			
Phenolic			
Fiberite			
4030-190	lb.	.95	1.13
FM6500	lb.	2.50	2.75
X1370	lb.	4.00	6.00
X1344, X2222	lb.	9.50	15.00
X1801	lb.	3.50	6.00
Vinyl			
Diamond			
PVC-25, 30, 35, 40, 60, 450, 500	lb.	.235	.42
PVC Flooring resins	lb.	.235	.42
CR-80	lb.	.28	.465
FCR	lb.	.245	.43
Apex Profile Extrusion			
495, 5600	lb.	.23	.25
497, 597	lb.	.2275	.2475
583	lb.	.32	.34
584, 585, 586, 586-A, 587, 588	lb.	.31	.33
801, 803, 804, 805	lb.	.22	.24
810	lb.	.2875	.3075
1100	lb.	.26	.28
1110	lb.	.315	.335
1111	lb.	.32	.34
1114, 1150	lb.	.325	.345
5800, 5802	lb.	.1825	.2025
5801	lb.	.1925	.2125
Special Use			
56-5	lb.	.30	.32
56-80, 595	lb.	.27	.29
57-10A, 58-74	lb.	.37	.39
57-113	lb.	.235	.255
58-14	lb.	.29	.31
58-52	lb.	.345	.365
58-89 A, B	lb.	.32	.34
58-98	lb.	.28	.30
58-137C	lb.	.41	.43
811	lb.	.2625	.2825
Wire and Cable			
117	lb.	.255	.275
120	lb.	.25	.27
125	lb.	.31	.33
126, 128	lb.	.26	.28
127	lb.	.2625	.2825
452	lb.	.36	.38
453	lb.	.355	.375
455	lb.	.32	.34
457, 458, 1200-17	lb.	.34	.36
590, 591	lb.	.2525	.2725
592	lb.	.2475	.2675
593, 596	lb.	.265	.285
597, 598, 599	lb.	.2275	.2475
850	lb.	.40	.42
1200-18	lb.	.35	.37

CALENDAR of COMING EVENTS

September 10-11
Society of the Plastics Industry, Inc. Midwest Section Conference. French Lick-Sheraton Hotel, French Lick, Ind.

September 10-11
ASME Wood Industries Conference. Multonomah, Portland, Oregon.

October 1-2
Society of the Plastic Industry, Inc. New England Section Conference. Wentworth-by-the-Sea, Portsmouth, New Hampshire.

October 7
SPE Cleveland Section RETEC. Vinyl Plastics. Cleveland Engineering Society, Cleveland, O.

October 13-14
SPE Southern California Section NATEC. Plastics Engineering—State of the Art Today. Ambassador Hotel, Los Angeles, Calif.

October 16
SPE Buffalo Section RETEC. Plastics Finishing. Niagara Hotel, Niagara Falls, N. Y.

November 8-10
Toy Production Show (originally scheduled for April 14-16). New York Trade Show Building, New York, N. Y.

November 16-19
National Academy of Sciences-National Research Council, Building Research Institute: Sandwich Panel Design Criteria. Shoreham Hotel, Washington, D. C.

November 19
SPE Golden Gate Section RETEC. Plastics in Packaging. San Francisco, Calif.

December 1-3
U. S. Army Signal Research and Development Laboratory. Wire and Cable Symposium. Berkeley-Carteret Hotel, Asbury Park, N. J.

January 12-15
SPE Chicago Section ANTEC. Conrad Hilton Hotel, Chicago, Ill.

January 26-27
Society of Vacuum Coaters. New York, New York.

February 2, 3, 4
Society of the Plastics Industry. SPI Reinforced Plastics Division Conference. Edgewater Beach Hotel, Chicago, Ill.

Domestic Production and Sales of Plastics and Resin Material, March and April, 1959

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of March and April, 1959. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	March, 1959		April, 1959	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,328,592	1,451,683	1,798,873	1,846,647
Sheets, 0.003 gage and over	1,676,399	1,638,506	1,914,359	1,706,607
All other sheets, rods, and tubes (including other cellulose plastics)	707,742	802,272	920,616	894,248
Molding and extrusion materials (including other cellulose plastics)	9,049,077	8,879,853	9,432,273	9,046,844
Nitrocellulose sheets, rods, and tubes	288,469	198,202	317,052	207,861
TOTAL	13,050,300	12,976,516	14,383,173	13,702,207
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	19,965,832	17,900,056	18,355,995	18,032,946
Bonding and adhesive resins for—				
Laminating (except plywood)	6,300,161	4,314,520	6,236,134	4,163,799
Coated and bonded abrasives	1,627,094	1,378,197	1,324,410	1,260,751
Friction materials (brake linings, clutch facings, and similar materials)	1,366,757	1,192,490	1,403,771	1,248,436
Thermal insulation (fiber glass, rock wool)	4,409,610	4,136,512	4,617,108	4,624,227
Plywood	4,790,917	3,612,484	4,923,204	4,248,878
All other bonding and adhesive uses	5,678,932	5,143,871	4,602,822	5,257,672
Protective-coating resins unmodified and modified except by rosin	2,712,769	1,932,187	2,631,590	2,273,011
Resins for all other uses	3,816,685	3,181,175	3,479,973	3,219,180
TOTAL	50,668,757	42,792,392	47,575,007	44,328,900
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,852,917	3,025,234	2,921,520	2,691,119
Paper-treating and paper-coating resins	2,654,508	2,229,077	2,658,148	2,213,364
Bonding and adhesive resins for—				
Laminating	2,719,379	2,260,622	3,135,166	2,368,058
Plywood	9,951,831	10,180,958	10,498,696	10,404,561
All other bonding and adhesive uses	1,717,733	1,912,510	1,543,227	1,401,573
Protective-coating resins, straight and modified	3,104,637	2,447,858	3,364,146	2,351,243
Resins for all other uses, including molding	10,167,233	9,538,520	10,808,645	10,343,836
TOTAL	32,628,238	31,594,779	35,229,548	31,773,754
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	24,415,795	20,040,997	20,175,267	20,690,784
All other	31,191,065	27,207,209	30,219,666	26,083,962
Protective-coatings	6,648,802	5,988,081	7,214,882	7,219,630
Textile and paper treating and coating resins	4,675,062	4,217,408	4,488,739	3,955,603
All other uses	13,423,853	14,338,443	12,741,318	16,729,365
TOTAL	80,354,577	71,792,138	74,839,872	74,589,344
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		6,611,699		7,526,277
Sheeting (resin content)		8,734,579		10,390,106
Molding and extrusion (resin content)		25,085,528		27,226,022
Textile and paper treating and coating (resin content)[3]		5,513,827		5,951,090
Flooring (resin content)		13,568,162		14,095,951
Protective coating (resin content)		2,536,765		3,038,020
All other uses (resin content)		8,013,994		8,375,597
All other vinyl resins for—				
Adhesives (resin content)		4,919,073		5,182,241
Protective coatings (resin content)		2,768,232		2,462,346
All other uses (resin content)		11,488,293		12,819,162
TOTAL	91,662,415	89,240,152	92,122,461	97,066,812
Coumarone-Indene and Petroleum Polymer Resins	23,059,062	23,098,450	21,133,287	21,123,145
Polyester Resins:				
For reinforced plastics	12,775,686	11,265,597	13,659,541	12,090,996
For all other uses	2,006,964	1,746,461	2,031,911	1,911,696
TOTAL	14,782,650	13,012,058	15,691,452	14,002,692
Polyethylene Resins:				
For film and sheeting		31,209,812		33,854,174
Molding materials		17,629,466		19,658,059
Extrusion materials		9,931,284		9,234,939
For all other uses		32,491,282		34,260,508
TOTAL	95,133,293	91,261,844	98,311,812	97,007,680
Epoxy Resins:				
For protective coatings		1,611,826		1,740,903
For all other uses		1,888,712		2,101,918
TOTAL	4,788,875	3,500,538	4,579,149	3,842,821
Miscellaneous Synthetic Plastics and Resin Materials, Including Silicone Resins	21,375,617	18,180,433	21,323,984	18,879,504
GRAND TOTALS	398,581,762	397,449,300	425,189,745	416,316,859

[1] Includes fillers, plasticizers, and extenders.
[2] Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3] Includes data for spreader and calendering-type resins.
SOURCE: United States Tariff Commission, Chemical Division.

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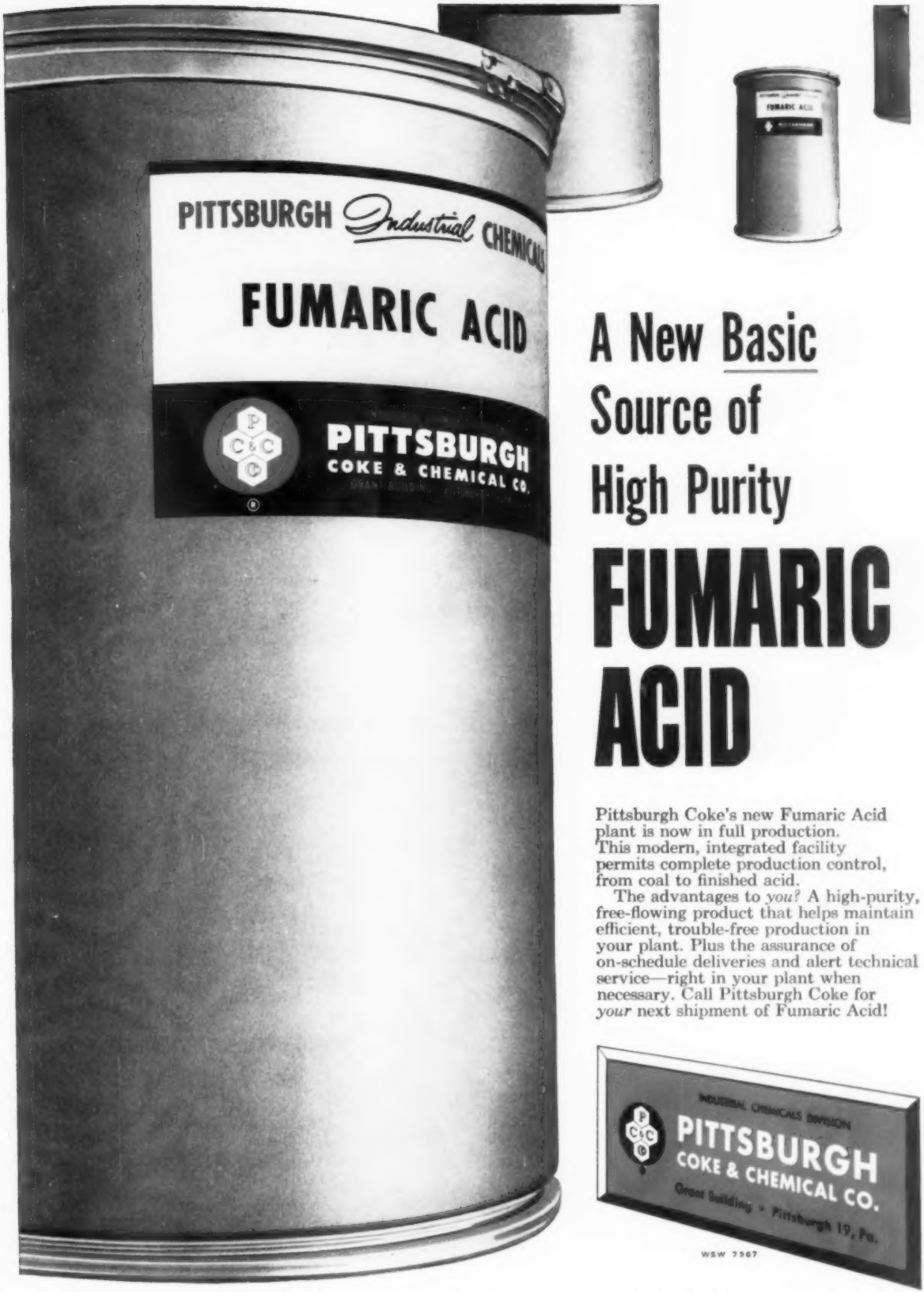

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